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A REPORT IN PARTNERSHIP WITH

CLIMATE ADVISERS

ZERO NET DEFORESTATION: STATUS REPORT

HOW FAR DO CURRENT NATIONAL TARGETS GET US?

About WWF-UK

WWF was established in 1961 and is at the heart of global efforts to address the world's most important environmental challenges. We work with communities, businesses and governments in over 100 countries to help people and nature thrive. WWF advocates for Zero Net Deforestation and Degradation of forests by 2020. We hope this report will help to increase the ambition on forests in the international climate process and under the new Sustainable Development Goals towards a zero deforestation future.

Acknowledgements:

This is a report compiled by Climate Advisers in collaboration with WWF.
For a summary version of this report and infographics of its findings visit
wwf.org.uk/znd2015

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EXECUTIVE SUMMARY

In a year when targets on forest loss and restoration are likely to be set nationally and at the UN level, this study quantifies the ambition of commitments currently stated by forest countries to slow and reverse their forest loss – individually and collectively.

Our report catalogues and analyses forest-related commitments and pledges made by 14 countries which together represent over half of current and projected tropical forest area loss. We seek to draw attention to the ambitious targets of some countries and the need for greater international support for meeting them, as well as to identify opportunities where additional ambition is possible. In selecting the 14 countries, we focused on those that fall within 11 global 'deforestation fronts' identified by WWF in 2015.

CURRENT TARGETS COULD REDUCE ANNUAL FOREST LOSS IN THE TROPICS IN 2020 BY AN AREA ABOUT THE SAME SIZE AS BELGIUM

We assess their commitments against two targets: first, the goal of Zero Net Deforestation and Degradation by 2020, as advocated by WWF (ZND-2020); and, second, halving the rate of natural forest loss by 2020 and eliminating it by 2030 (ZND-2030). The latter is based on the timeline in New York Declaration on Forests made in September 2014.

Our findings show that if the commitments catalogued in this study were delivered successfully, they would reduce annual net forest loss in *deforesting tropical countries*[1] by 30% in 2020 and 28% in 2030. This is compared to the projected loss for each year without the targets[2,3].

An additional 1.1 million hectares of restoration effort is targeted by 2020 in several countries that could be considered on course for ZND-2020 – namely Colombia, Ecuador and Peru – and the Democratic Republic of the Congo which could reach ZND-2030. Indonesia and Papua New Guinea could also reach ZND-2030.

Altogether, this would amount to a reduction in net forest-related emissions of 40% in 2020 and 53% in 2030 against emissions in the projected loss scenario. This could achieve annual reductions of 1.9 GtCO2e in 2020 (more than three times the annual emissions of the UK) and 2.7 GtCO2e in 2030[4].

INTRODUCTION

Forests are critical for people and climate

The health of the world's climate is intimately entwined with the health of its forests. One third of the excess carbon dioxide in the atmosphere since 1750 has come from deforestation[1]. Agriculture, forestry and other land uses are responsible for nearly a quarter (24%) of all anthropogenic greenhouse gas (GHG) emissions – emitting 10-12 GtCO2e annually, about half of which derives from net deforestation and forest degradation (12%)[2]. Because deforestation and forest recovery are happening in different places, this net figure masks the true scale of forests' impact on emissions. This is because while tropical forest loss makes up 16-19% of the global total of emissions, at the same time removals from the atmosphere due to forest growth offset about 8-11% of total anthropogenic emissions[3].

THE FATE OF THE WORLD'S FORESTS IS PIVOTAL TO OUR FUTURE CLIMATE. BUT REGULATING OUR CLIMATE IS JUST ONE OF THE MANY SERVICES THEY PROVIDE

Forests can be a big part of the climate solution. Reaching a target of zero natural forest loss by 2030 would keep 29-54 Gt CO2 more emissions out of the atmosphere than would be the case if deforestation continued on a business as usual path. Achieving this sooner would do more. Restoring 350 million hectares of forest by 2030 would sequester an additional 12-33.5 Gt CO2[4]. In total, these actions would avoid around 5-10% of the total 'budget' of GHG emissions it's considered we can make up until 2100 while still having a good chance of containing temperature rise below 2°C[5] – and they can achieve this in the next decade and a half.

Regulating our climate is just one of many ecosystem services forests deliver locally and globally. Others include protection against floods, landslides, avalanches and ocean surges and providing clean water, fish, medicines and crops[6]. They are also important as places for recreation and for the world's various faiths. These services also underline the role forests can play in climate adaptation. Some estimates have put the value of the combined ecosystem benefits of intact tropical forests at an average of US$6,120 per hectare per year[7].

Their benefits are far-reaching. Before counting the global benefits, over one billion people depend directly on forests for all or part of their livelihood. When you include the role forests play in providing shelter, water, fuel and food security this figure rises to two billion[8]. Most of the value provided by forests – both locally and globally – is not monetised in the formal economy, leaving forests highly exposed to more harm than protection.

Forests continue to be lost

Yet, forests are not faring well globally. Some of our most critical forests are rapidly disappearing or being fragmented. The last FAO assessment of global forest resources estimate global loss at 13 million hectares per year from 2000 to 2010, slowing somewhat over the decade[9]. Other sources suggest that tree cover loss is significantly greater than suggested by these rates of forest loss and trending up rather than down[10]. While scientists interpret the details differently[11], there is clarity on the big picture risks.

In the final chapter of its *Living Forests Report*, released in April 2015, WWF developed the concept of deforestation fronts as a way of identifying and describing those places at imminent risk of undergoing large-scale deforestation. WWF drew on projections in the Living Forests model, a major literature survey and interviews

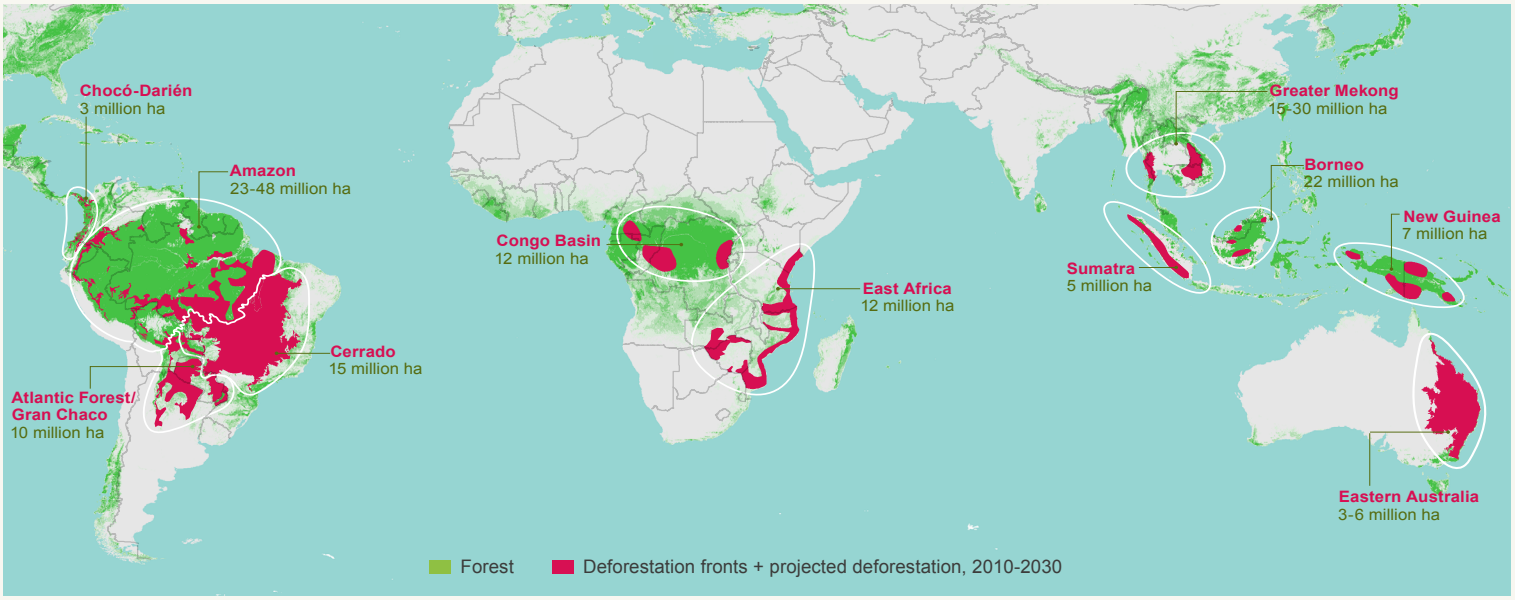


Figure 1: The 11 deforestation fronts identified by WWF for the period 2010-2030.

(Source: *WWF Living Forests Report Chapter 5: Saving Forests at Risk*, 2015)

with dozens of experts around the world to identify 11 places with major deforestation fronts, highlighted in the map above. In these places, the bulk of global deforestation is projected to take place over the next two decades unless there are interventions to prevent losses. In total, the forest area loss in these fronts could be 127-170 million hectares – up to the size of Germany, France, Spain and Portugal combined – amounting to as much as 80% of global forest loss over the period[12].

The causes of forest loss and degradation vary somewhat between countries and regions, with one general exception: the expansion of commercial agriculture is identified as an important driver of deforestation by nearly every tropical country in their national REDD+ strategies[13]. Other drivers or associated developments include infrastructure developments, small-scale and shifting agriculture, fires, wood fuel demand and unsustainable logging[14].

The future of forests: Signs of hope and a growing consensus

So what future can we expect for the world's forests? We note two signs of hope. First, there is new and rather clear evidence that deforestation can be stopped without slowing the growth of rural economies. Nepstad et al. (2014) argued that the 70% decline in deforestation in the Brazilian Amazon by 2013 on the 10-year average up to 2005 suggests that it is possible to manage the advance of a vast agricultural frontier. He found that enforcement of laws, interventions in soy and beef supply chains, restrictions on access to credit and expansion of protected areas contributed to this decline, as well as a decline in the 'demand' for new deforestation. At the same time in Brazil the soy and beef sectors – the principal drivers of forest clearance – went through a significant growth period. Brazil has shown that increases in agricultural production can be uncoupled from deforestation[15].

Second, there is a gathering global consensus towards stopping forest loss. Integration of deforestation into the international climate process has elevated forest loss to a leader-level issue. This has led to a proliferation of new commitments to protect and restore the world's forests. Perhaps the most significant of these is the New York Declaration on Forests (NYDF) signed in September 2014 at the United Nations leaders' summit on climate change. It was signed by dozens of governments (national and sub-national), companies and civil society organisations. The Declaration collectively committed its signatories to work together toward two outcomes in particular[16]:

- At least halve the rate of loss of natural forests globally by 2020 and strive to end natural forest loss by 2030.

- Restore 150 million hectares of degraded landscapes and forestlands by 2020 and significantly increase the rate of global restoration thereafter, which would restore at least an additional 200 million hectares by 2030.

This Declaration builds upon other international targets. For example, in 2010, Parties to the UN Convention on Biological Diversity (CBD) agreed to the Aichi Biodiversity Targets, which include halving natural forest loss by 2020 and enhancing ecosystem resilience including through restoring at least 15% of degraded ecosystems[17].

Explicit forest targets have also been proposed by the UN Open Working Group on Sustainable Development Goals (SDGs). The SDGs – forming the post-2015 development agenda to succeed the Millennium Development Goals – are the subject of negotiations this year ahead of a summit of world leaders in September. The Open Working Group on SDGs, which was established to draft the goals originally proposed in target 15.2 that 2020 be the date by which to 'halt deforestation'[18]. However, the latest proposals – as of May 2015 – from the facilitators of the international negotiations suggest pushing the date back to 2030, in line with the New York Declaration[19]. The response of the international community remains to be seen.

WWF: Setting a high bar and focusing on the future

Notwithstanding its support to important agreements like those set out above as a global leader in efforts to protect the world's climate and ecosystems WWF advocates for 'Zero Net Deforestation and Degradation' (ZNDD) by 2020 as a challenging but achievable objective (see Box 1). This ambitious 2020 target is a significant opportunity to meet the emissions reductions needed to reach global climate targets; delaying the achievement of this goal to 2030 could result in 24 Gt CO2e more emissions.

Box 1

Zero Net Deforestation and Degradation

WWF envisions a world where humanity lives within the Earth's ecological limits and shares its resources equitably. It advocates **Zero Net Deforestation and Degradation** (ZNDD) by 2020 as a critical milestone toward this goal[20].
ZNDD means *no net forest loss through deforestation and no net decline in forest quality through degradation.*

This is not quite the same as no forest clearing anywhere, under any circumstances. For instance, it recognises peoples' right to clear some forests for agriculture, or the value in occasionally 'trading off degraded forests to free up other land to restore important biological corridors, provided that biodiversity values and net quantity and quality of forests are maintained. In advocating ZNDD by 2020, WWF stresses that: (a) most natural forest should be retained – the annual rate of loss of natural or semi-natural forests should be reduced to near zero; and (b) any gross loss or degradation of pristine natural forests would need to be offset by an equivalent area of socially and environmentally sound forest restoration. In this accounting, plantations are not equated with natural forests as many values are diminished when a plantation replaces a natural forest.

With the International Institute for Applied Systems Analysis, WWF developed the Living Forests Model to consider a range of future forest scenarios and to project the effects of changes in diet, bioenergy, conservation policy, and fuelwood and timber demand[21]. The model shows that with better forest stewardship and more productive use of arable land, the current and projected demand for food, fuel and fibre could be met without further net loss of forests. Achieving ZNDD by 2020 depends on preventing further forest loss due to poor planning, weak governance, inequitable or insecure land tenure and user rights, unregulated or illegal forest clearing, poor forest management, inefficient agriculture and overuse of fuelwood.

A moment for forests

In 2015, there is a unique opportunity for the world to act more firmly on the emerging vision of a zero-net deforestation future. In September, the international community will seek agreement on the SDGs. In December, parties to the UN Framework Convention on Climate Change (UNFCCC) plan to agree a global deal in response to the threat of climate change.

Critical to the zero-net deforestation future will be the nationally determined contributions every country is expected to put forward prior to the Paris UNFCCC meeting. Two tropical forest countries, Mexico and Gabon, have already submitted their pledges at the time of publication. Mexico has pledged to reach zero deforestation by 2030[22]. Gabon set a 2025 target of containing its overall GHG emissions to more than 50% below 'business as usual' and included efforts to address land use change in its planned actions[23]. Some forest countries have shown signs that they are willing to make deforestation reduction a significant part of their contribution to global climate efforts. Take, for example, the 14 countries[24] that issued the 'Lima challenge' and stated their willingness to undertake 'significant efforts nationally to implement large-scale climate change mitigation actions' under their own effort and 'even more in partnership.'[25] Others have also made significant commitments to restoring degraded forest and other landscapes. And 14 countries[26] have committed to restoring a total of 59.2 million hectares of land under the Bonn Challenge, which aspires to initiate 150 million hectares of forest restoration by 2020.

SOME COUNTRIES HAVE SHOWN THEY ARE WILLING TO REDUCE FOREST LOSS AS A SIGNIFICANT PART OF THEIR CONTRIBUTION TO GLOBAL CLIMATE ACTION

However, finance pledged by developed countries to date has been insufficient to match the audacity of the goals we are together agreeing to achieve. Certainly some developed countries have provided leadership by committing to help resource the implementation of forest sector action. Notably, Germany, Norway and the United Kingdom issued a joint statement alongside the New York Declaration on Forests that expressed their 'shared intent to support provisions for adequate, predictable, sustainable financing for REDD+, including results-based finance … to up to 20 new emission reduction programs proposed by 2016.'[27] Together with the United States and Japan, these countries account for 75% of all international pledges of REDD+ finance to date[28].

Total REDD+ finance pledges from all sources total about $1 billion per year on average from 2006 to 2013, much of which has not been disbursed[29]. While estimating the financing need for REDD+ is notoriously difficult, it is clear that it will take more than $1 billion per year to reduce emissions by the 4.5 to 8.8 GtCO2e estimated for the New York Declaration on forests, which would translate into less than US$0.22 of current finance per tonne of globally targeted 2030 reductions.

The advanced economies should not miss this opportunity through the climate negotiations in 2015 to respond to the Lima Challenge and match forest country ambition with a level of support commensurate with the challenge. The world's forests and climate depend on it.

How this study contributes

This study seeks to quantify the targets that forest countries have set for themselves to slow and reverse forest loss, individually and collectively. It catalogues and quantifies forest-related commitments, goals and pledges by a selection of 14 countries that represent 51%[30] of global forest area loss at current levels, with a focus on countries with forests in the 11 global deforestation fronts.

We assess these commitments against two measures: the WWF objective of zero net deforestation in 2020 (ZND-2020) and a less ambitious trajectory of halving the annual rate of deforestation by 2020 and eliminating it in 2030, based on the targets in the New York Declaration on Forests (ZND-2030).

THIS ANALYSIS IS DESIGNED TO INCREASE TRANSPARENCY ON NATIONAL AND GLOBAL TARGET SETTING ON FORESTS, AND THEREBY HELP INCREASE AMBITION

This analysis is designed to provide a measure of clarity and transparency on national and global target setting that is, to date, lacking in the forest-climate space. We hope that such clarity will help increase the ambition of forest sector pledges in the international climate process leading up to the Paris climate conference. And we hope it will shine a light on the need for national level responses — including from advanced economies — to the New York Declaration on Forests and the emerging forest sustainable development goals.

While we seek to identify gaps between existing commitments and the potential for forest-sector mitigation, the reader should be careful not to confuse our identification of such gaps with an attempt to assign responsibility for closing them. Every country will decide for itself the level of ambition of its climate pledges – and the extent to which its actions will be conditional on the provision of adequate finance from other countries.

However, where there are significant gaps, there are significant opportunities. We hope that identifying these gaps will be a step towards closing them, through a mix of strong own-action pledges from forest countries that are able; ambitious additional and conditional pledges from forest countries that would seek further action through partnerships with rich countries; and ambitious explicit pledges from the rich countries that they will partner with forest countries to help protect the forests that provide so many benefits to us all.

This is not a study into actual changes in forest cover. It is a comparison between the declared intent from government policies and globally stated ambitions. It is a look into the future. Needless to say, the monitoring of trends of actual forest loss is essential and others will take up this mantle. However, it is impossible to interpret the declared intent of governments with respect to their forests without examining historical patterns of forest area and emissions. In fact, data availability and quality drives a substantial bulk of the analysis – but ultimately the goal is to derive an understanding of intent; not of facts on the ground.

Equally, it is not possible to project the impact of the many corporate commitments to removing deforestation from their supply chains, most notably that of the Consumer Goods Forum members to zero net deforestation by 2020. Determining what private sector action would achieve where government policy is not in place is a complex analysis beyond the scope of this study. Nevertheless, some consideration to this interplay is given for specific countries.

METHODOLOGY

Zero net deforestation

As discussed above, one of the primary yardsticks for this analysis is be WWF's Zero Net Deforestation and Degradation concept (see Box 1 above). But we exclude the second 'D' (degradation) from this analysis: it is inconsistently defined, poorly understood and accounted for globally[31] and few countries measure and report it consistently let alone set targets to reduce it.

The omission is necessary, but regrettable. It's likely that the emissions from forest degradation are significant[32] and rising[33]. The author and WWF are both deeply concerned that our data-limited blind spot for degradation may, in a sense, be allowing the global forest advocacy community to see the forest (loss) but miss the tree (loss). We hope that ongoing research and technological leaps in forest remote sensing will excise this potentially dangerous cataract soon.

CARE MUST BE TAKEN TO AVOID THE REALISM OF A 'NET' TARGET MASKING THE IMPORTANCE OF ACHIEVING 'NEAR ZERO' NATURAL FOREST LOSS

There remain many questions and challenges in consideration of the first 'D.' Whether we find that we are on course for ZND depends critically on the spatial scale of the analysis and on definitions of terms (most notably, what we count as forests). For example, have we achieved what we seek if the world meets ZND at the global scale because large-scale reforestation of temperate Chinese forests balances out tropical deforestation in Indonesia? What if it is the expansion of monoculture forest plantations in Australia instead of temperate native forests on the 'plus' side of the net equation?

Clearly neither of these situations meets the objective of near zero natural forest loss, where non-zero loss is balanced by environmentally sound restoration.

If we step down from the global to the national scale, ZND is a much more challenging and ambitious target. But care must still be taken not to allow the realism of a 'net' target to mask the importance of a 'near zero natural loss' target. It is a judgment call as to what counts as 'near zero' and might be judged differently for different countries. As a result, WWF has deliberately not previously defined 'near zero' numerically, but for the analysis in this study we need to use an illustrative number. So, in this study, we consider 'near zero' rates of natural forest loss to be in the range of 0.1-0.2% per year.

Data selection

The forest sector is in the throes of a data revolution. Increasingly sophisticated, transparent and easily accessible analysis of satellite imagery has made it possible to generate measures of tree cover and tree cover loss for every hectare on Earth at scales ranging from just a few trees to the entire globe[34]. The forest sector also has a long history of compiling country-reported data based on national inventories and using a range of forest definitions (i.e. what we count as forests), field survey methodologies, and different tiers of data quality within defined boundaries. These methodologies underpin the reporting to and by multilateral and quasi-governmental bodies such as the FAO and UNFCCC. These vastly different approaches, perhaps not surprisingly, lead to very different types of information and have generated some amount of uncertainty and confusion[35].

While this paper is not intended to provide a guide to these various data sources, it is important to understand a few key principles and differences. Both types of sources add value to this analysis, and we use both.

WHILE THIS PAPER IS NOT INTENDED TO PROVIDE A GUIDE TO THE VARIOUS FOREST COVER DATA SOURCES, IT IS IMPORTANT TO UNDERSTAND A FEW KEY PRINCIPLES AND DIFFERENCES BETWEEN THEM

FAO and self-reported sources

The Food and Agriculture Organisation of the United Nations (FAO) has undertaken global Forest Resource Assessments (FRA) at five to 10 year intervals since 1945. The four-year cycle of generating reports includes surveying and collating data from government-nominated national correspondents and their teams, expert consultations, and regional workshops. The most recent report (FRA 2010) and associated tables report about 90 variables for 233 countries and territories for 1990, 2000, 2005, and 2010. These are available in six languages; all country reports are publicly available. The Statistics Division of FAO makes FRA data available online in a common format with other FAO data (FAOStat), as well as compiling data across different FRA reports, interpolating between years, and providing other data quality filters. We have extracted five primary data series from FAOStat for this analysis, and have derived two additional series, to estimate forest area, gross deforestation, net deforestation, forest area gain, CO2 emissions from gross deforestation, CO2 emissions and sequestrations from remaining forest, and net forest land CO2 emissions.

The most important point to note about the FAO data is that 'forest' is defined from a land use perspective rather than the common understanding of a forest as a place with trees. Forest status is determined both by the presence of trees and the absence of other land uses. For example, it excludes land that is primarily under agriculture or urban land use. It includes areas both 'temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within five years.'[36]

As such, the definition of land as 'forest' in FAO reports is an inherently political one: by including notions of 'temporarily unstocked' and 'expected to be regenerated,' the definition depends intimately on governance, land use plans, and zoning – the likely or intended future of the land, not just its present status. These are political determinations rather than biophysical; such forward-looking plans cannot be observed by satellites. At the same time, they may be intentionally or unintentionally misleading, representing a future forest regrowth that may never occur.

In addition to FAO reporting, many countries have also reported forest extent, status, and emissions to other international bodies. These include national reports and plans submitted to the Convention on Biological Diversity (CBD), and national communications to the UNFCCC. We have consulted these additional country-reported sources when available.

Satellite and remote sensing data

In 2013, a group of researchers led by Dr Matthew Hansen published a global map of tree cover extent, loss, and change, commonly known as the Hansen dataset[37]. The Hansen dataset, updated since its release to include 2013, and made easily and globally available as a core element of WRI's Global Forest Watch, has rightly been considered a breakthrough[38]. Its benefits include global comparability across jurisdictions, high spatial and temporal resolution, easy accessibility and methodological transparency. But it, too, is flawed when it comes to measuring 'deforestation' as defined by either IPCC or FAO. The Hansen methodology statistically estimates the presence or absence of a tree canopy meeting certain biophysical criteria of height, cover and extent. But it says nothing about the causes of tree cover loss (whether caused by humans or not), nor about the future of the land (whether expected to recover as a forest or not). It also does not distinguish (yet) between natural forests, plantation forests, or even agricultural forests (e.g. palm oil, fruit trees). Also notable is that Hansen (2013) only provides

area estimates, not emissions – which is of primary interest in the climate community. Even with these caveats, the new comprehensive view of global forests via satellite is revolutionary. The Hansen data enter into this analysis in several ways (see below).

A few additional data sources that are ultimately derived from remote sensing are considered in the analysis. To convert Hansen tree cover change into emissions estimates, we multiply by national average carbon density estimates from Saatchi et al (2011)[39]. National level forest restoration potentials are estimated from Potapov et al (2011)[40].

A third set of remote-sensing-derived forest and land use emissions estimates are displayed along with other sources in some charts, but were generally excluded from our analysis. These three sources – WRI's CAIT[41], JRC/PBL's EDGAR[42], and UNEP's 2014 gap analysis[43] – derive forest and other land use emissions estimates from fire emissions observations. The models they use to do this are not fully transparent, and all warn against their use specifically to analyse the forest sector.

Our approach to data differences at the national scale

Both types of forest data – self reported and remotely sensed – provide insights. We therefore compile as many of the relevant sources as possible, and look to them for whatever information they may provide[44]. However, ultimately we seek to synthesise and draw conclusions, so must choose which line on the graph to use.

WE USE A HIERARCHY OF DATA SOURCES. FROM COUNTRY REPORTING TO THE CLIMATE PROCESS, TO COUNTRY REPORTING TO THE FAO, AND FINALLY SATELLITE DATA

As noted above, this is not a study into actual changes in forest cover. It is a study of political ambition, intent and opportunity. The units of analysis are not just hectares and tonnes, but also commitments. The pledges and targets countries have put forward in their forest sectors are more likely to reflect their own political understanding of their forest lands, than a scientific or biophysical meaning of forest. Therefore to understand the likely intent of countries' pledges, and the implications of such pledges on forest area and emissions, we decided it was best to put them in the context of countries' self-reported forest statistics whenever possible.

This suggests a hierarchy of data sources. We look first to country reports in the climate context, as that is the context where additional pledges and commitments are most likely to emerge in 2015. If unreliable or unavailable, we look next to country reporting to the FAO and occasionally the CBD. The Hansen data provides a check on the self-reported data, both in terms of area and emissions (after the Saatchi multipliers are applied): if there are large mismatches that can't be easily and transparently explained, the additional digging is needed to 'trust but verify.'

An unexpected need identified

While we entered into this research with the intent to focus primarily on the extent of forest sector ambition and pledges and potential gaps, it quickly became apparent that inconsistent data, unclear baselines and unclear definitions make the assessment of commitments by individual countries quite difficult.

This is not a mere technical issue, even though technical solutions may exist. The future of forests as a large-scale integrated climate change solution is at stake. It will be impossible to generate sufficient political will and investment in deforestation reduction efforts if there is a broad perception that some targets and goals are so mired in uncertainty as to be nearly meaningless. We thus consider below in the recommendations section whether there are needs for additional data, transparency or reporting.

Country selection

We used five criteria to select countries for the analysis: future expected deforestation, forest land extent and recent net change, and forest cover extent and recent net change.

As discussed above, WWF has identified 11 places on Earth where large-scale deforestation or severe degradation is projected between now and 2030 – the so-called 'deforestation fronts'. The set of countries with forests in the deforestation fronts are weighted heavily for selection because they face likely future pressure on their forests.

WWF's analysis and research also identified a putative 12th front — the boreal forests of the world — where changes are likely to be large but more focused on degradation than on deforestation. Recently released data for 2013 tree cover changes identified Canada and Russia as losing the most tree cover globally[45]. An extensive analysis of the boreal forest zone is beyond the scope of this paper. However, we will briefly touch on the forest trends and commitments of three developed countries with significant boreal forests – the United States, Canada and Russia – which together contain more than a third of global forest area.

WE SEEK TO INCLUDE IN THE ANALYSIS COUNTRIES THAT REPRESENT A SIGNIFICANT PROPORTION OF TOTAL FOREST AREA AND LOSS

We seek to include in the analysis countries that represent a significant proportion of both total forest area and forest loss, across the spectrum from low to high current deforestation rates. Both FAO estimates and Hansen estimates were included in the country selection, for both total area and net area change.

To select countries to include, we assigned every country in the world a weighted score based on our five criteria. We weighted each of the 11 deforestation fronts by assigning points to each country in the deforestation front based on the proportion of forest area in that country compared to forest area of all countries in that deforestation front. We assigned additional points based on country rankings of total forest area (FAO) and total forest cover (Hansen). And assigned a number of points based on country rankings of forest area loss from 2000 to 2010 (FAO) and forest cover loss from 2000 to 2012 (Hansen).

The deforestation front weights (which capture some measure of expected future deforestation, and ensure geographic balance across continents and ecologically significant forest zones) were allowed to dominate over the historical rankings. Only three countries (China, Australia and Venezuela) were excluded from the primary sample that scored higher than the lowest scoring country in the selection (Paraguay). As a net reforesting country with forests stretching from tropical to temperate zones, and with no expectation of future climate-related support in the forest sector, China was excluded even though some of its forests are in the Mekong deforestation front. As the only developed country (and a non-REDD+ country) with substantial tropical forest and savannah, Australia was also set aside from the primary analysis. The policy landscape of both China and Australia were, however, considered alongside the US, Canada and Russia in another way below.

Finally, Paraguay was selected over Venezuela to capture a fourth Gran Chaco/Atlantic Forest country, rather than including a sixth Amazon country. Many African countries and a few others came close to the cut off using this weighting; Central African Republic, Cameroon, Zimbabwe, Nigeria, Mexico, Laos, Vietnam, Angola, Sudan and India would be the next 10 countries.

Table 1. Country selection

		FAO data				Hansen data				
Country	Deforestation Fronts	2010 Forest Area (million ha)	Rank	2000-2010 Forest Loss (1,000 ha/yr)	Rank	2000 Forest Area (million ha)	Rank	2000-2012 Net Cover Loss (1,000 ha / year)	Rank	Score
Brazil	Amazon, Cerrado, Gran Chaco/Atlantic Forest	520	2	2,642	1	519	2	2,789	1	29.2
Indonesia	Borneo, Sumatra, New Guinea	94	8	498	3	161	7	1,301	5	28.9
DRC	Congo, Coastal East Africa	154	6	311	7	199	5	478	7	16.5
Colombia	Amazon, Choco-Darien	60	13	101	28	82	8	207	14	10.4
Bolivia	Amazon, Gran Chaco/Atlantic Forest	57	15	290	9	65	10	245	11	4.0
Malaysia	Borneo	20	29	114	30	29	21	391	8	2.8
PNG	New Guinea	29	22	141	19	43	15	53	37	2.6
Tanzania	Coastal East Africa	33	19	403	5	26	24	108	21	2.6
Mozambique	Coastal East Africa	39	18	217	13	29	22	138	17	2.3
Myanmar	Greater Mekong	32	20	310	8	43	16	119	19	2.2
Ecuador	Amazon, Choco-Darien	10	53	198	14	19	34	43	42	2.0
Argentina	Gran Chaco/Atlantic Forest	29	21	246	11	39	18	346	9	2.0
Paraguay	Gran Chaco/Atlantic Forest	18	33	179	15	24	28	304	10	1.8
Peru	Amazon	68	11	122	18	78	9	127	18	1.8
Sub Total*		1,164		5,770		1,357		6,649		
Percent Global		29%		56%		34%		38%		
Percent Tropical		51%		58%		60%		71%		
China	Greater Mekong	207	5	-2,986	216	163	6	489	6	9.8
Russia	Boreal	809	1	18	208	761	1	2,623	2	2
Canada	Boreal	310	3	0	98	418	3	2,112	3	2
United States	Boreal	304	4	-383	215	279	4	2,108	4	2
Australia	east Australia	149	7	562	2	42	17	222	12	4
Sub Total*		1,779		580		1,664		7,554		
		44%		6%		42%		44%		
Total*		2,943		6,350		3,020		14,203		
		73%		61%		76%		82%		

*Totals for forest loss columns including only countries losing forest and omit offsetting forest area gains. For example, China's forest area gain is not included in the total 2000-2010 Forest Loss Total estimate, nor the percentages.

Country and regional analyses

For each country, we created a set of time series from 1990 to the most recently available year for net and gross forest area change, and forest area gain on the one hand; and net and gross forest emissions, and forest sequestration, on the other. We used the hierarchy of data choices outlined above. We also collected information on the form and meaning of as many national commitments as could be identified (see below).

FOR EACH COUNTRY WE MODEL A 'TARGET' PATHWAY TO REPRESENT THE TOTAL IMPACT OF ALL RELEVANT GOALS, TARGETS AND COMMITMENTS

For each country we model a 'Target' pathway to represent the total expected impact of all relevant goals, targets, and commitments that were identified (see below). For a few countries where there is large uncertainty in intent or meaning of commitments, we model more than one target pathway to illustrate a range. But ultimately we settle on one for the global analysis.

The target pathway should not be confused with a crediting pathway or Forest Reference Emissions Level (FREL) – i.e. a target that, if exceeded, would generate international payments. For Indonesia and Brazil, we assess their targets in the context of their FRELs; if they successfully meet their targets, the amount of reduction eligible for international finance is clear. For most countries we do not have, nor do we try to assign or estimate, an FREL.

For countries that have not set explicit target pathways, we use the historical average from 2000-2012 as a reference. Our use of a historical average as the 'Target' pathway should not be interpreted as a suggestion about the appropriateness of any specific target or reference level for a country: it is merely the simplest assumption to avoid potential biases.

There are two exceptions. The Democratic Republic of the Congo (DRC) and Papua New Guinea (PNG) are both 'high forest cover-low deforestation' (HFLD) countries that have defended using an increasing deforestation rate as a reference level. In the absence of other information about their targets, we follow their lead in this case and set their Target pathway to match the reference level assumption.

We model 'ZND-2020' and 'ZND-2030' scenarios for each country if existing targets are not sufficient to reach these objectives. Finally we calculate the difference between these pathways in 2020 and 2030. These ZND pathways are not intended to suggest that forest countries have not been aggressive enough with existing commitments, but rather are intended to represent a reasonable measure of maximum opportunity.

We also seek to assess the collective impact of these various country pathways at regional and pan-tropical scales. Of course it is rather simple to add the area and emissions targets for the 14 countries in the sample. However, to put these totals in context, we must also compare these scenarios to a reference case of area of forest loss in each region considered. For these reference levels – or 'projected loss' as we call them below – we take the countries in the tropical region[46] and sum all the national net forest loss estimates across all countries for which net forest change is negative. In other words, we add up deforestation for only those countries that are, on balance, losing forest and which we call deforesting tropical countries.

We assume that total net forest loss across those countries not in the sample would increase somewhat from the historical level through 2020, as some HFLD countries will likely suggest increases as DRC and PNG have done. The projected loss countries in the sample are their FREL (if there is one), the increasing reference levels for DRC and PNG, and the historical averages for other countries (as described above).

THE TOTAL PROJECTED FOREST LOSS IN THE TROPICS IS CALCULATED BY ADDING UP THE LOSS OF ONLY THOSE TROPICAL COUNTRIES WHO ARE NET DEFORESTERS. THIS AVOIDS OFFSETTING BETWEEN COUNTRIES, AS STIPULATED IN THE ZND GOAL

The strength of this approach to aggregating across countries is that it explicitly avoids offsetting forest loss in one country with forest gain in another country in regional estimates, thus maintaining the standard that ZND requires 'near zero natural forest loss' at the country level. This is reasonable to the extent that forests within a country are similar and forests across national boundaries dissimilar. The approach also has weaknesses: we exclude the forest area changes in countries like China, India, and Vietnam that are expanding forest area. Our choice is to model 'national net' forest area change, even in our regional summaries – thus avoiding cross-border offsetting. The regional summaries thus answer the question 'how far do the targets of countries in our sample collectively go towards reaching zero net deforestation for all countries in the region with recent histories of net forest loss?'

Commitments

We catalogued the following types of forest sector commitments and pledges:

i Copenhagen commitments, compiled from UNFCCC submissions and Carbon Action Tracker.

ii New York Declaration on Forests signatories are considered to be committed to cutting natural forest loss in half by 2020 and ending it by 2030. We apply the same 'near zero' criteria to these countries as in the definition of ZND in Box 1: annual rates of gross natural forest loss in the range of 0.1-0.2% per year are considered to be 'near zero' and meeting this commitment if offset by an equivalent or greater area of socially and environmentally sound forest restoration.

iii The natural forest restoration component of Bonn challenge and other restoration pledges.

iv Rio Branco declaration signatories: for a few countries, we assess the potential impact of sub national targets of 80% cuts in deforestation by collections of states and provinces.

v Domestic forest sector strategies and plans: in a very few cases we include explicit targets in national planning documents.

Box 2

Supply chain deforestation-free pledges

An increasing number of corporations are committing to voluntarily eliminate deforestation from their supply chains for some commodities. Most broadly, the companies of the Consumer Goods Forum agreed to work together towards achieving this end for supplies of beef, soy, palm oil and pulp and paper by 2020. Some companies have announced more aggressive specific time lines. While most of these types of commitments have not even kicked in yet, they are already catalysing change.

The key question for this analysis is not, however, whether these commitments are effective (just as we do not ask whether government pledges are effective). Instead, we address these three questions:

1. Should such commitments be assessed with the same seriousness as those from sovereign states and sub national governments?
2. Can the deforestation reduction impact of such commitments be reliably estimated with existing data?
3. If the answer to both of the previous questions is yes, then can these supply chain commitments get the world, particular regions, or the nations in our sample closer to zero net deforestation than they would have been without them?

Generally speaking, we firmly believe that the commitments made by non-governmental actors are critical to reducing and reversing deforestation. They not only change the incentives on the ground for combating deforestation through the purchasing power of the huge global market for commodities, they can also help generate the political will for the countries to make (and implement) significant commitments to changing land use patterns. In terms of question 1 – whether such commitments are serious and important enough to consider for an analysis like this – we would conclude with a 'yes'.

It is much more difficult to estimate the impact of such commitments. Many other studies assess the amount of forestland converted to the production of one commodity or another, at global, national and sub national spatial scales. Tying such conversion – especially future conversion – to the specific supply chains of a particular company or group of companies and thus the scope of a particular zero-deforestation pledge, is incredibly difficult. Such data are just not available at the core national scale of this analysis. So we must answer a qualified 'no' to the second question – at least for the country level analysis.

We do, however, include some analysis of corporate supply chain commitments below in two boxes, assessing whether fully eliminating deforestation for a particular commodity or commodities suggests more ambition than the set of analysed targets in two country-commodity combinations (soy and beef in Brazil and palm oil in Indonesia).

Table 2. Pledges and Commitments

Country	Target	Base Year	Goal Year	Est. Period	Type	Source
Argentina	Initiative 20x20 Restoration of 2.05 million hectares, half of the Conservación Patagónica pledge (Chile/Argentina)		2020		Unconditional	Initiative 20x20
Bolivia	Increase forest coverage by 10% of the area degraded and deforested in the next 10 years	Undef	2019 or 2020	Undef	Conditional	Government of Bolivia, 2009
Brazil	Reduce 80% of the annual deforestation rates in the Legal Amazon	1996-2005	2020	2006-2020	Conditional	Alcobe 2014
	Copenhagen reduced deforestation in Amazon target: Reduce deforestation in the Amazon to achieve 564 million t CO2e by 2020		2020	2020	Conditional	Parker 2014
	Reduce 40% of the annual deforestation rates in the Cerrado	1999-2008	2020	2010-2020	Conditional	Alcobe 2014
	Copenhagen reduced deforestation in Cerrado target: Reduce deforestation in the Cerrado to achieve 104 million t CO2e by 2020		2020	2020	Conditional	Parker et al 2014
	Expand forest plantations by 3 million hectares. (excluded)		2020	2010-2020	Conditional	Alcobe 2014
	Copenhagen Pledge - 36.1 to 38.9% below BAU for overall emissions	BAU	2020		Conditional	Climate Action Tracker
	Pacto para Mata Atlantica: 15 million hectares restored by 2050		2050		Conditional	Pacto Mata Atlantica
	Bonn Challenge Pledge: 1 million hectares Mata Atlântica restoration		2020		Conditional	Bonn Challenge
	Rio Branco Declaration: 6 Brazilian States commit to 80% reduction in deforestation by 2020				Conditional	CGF 2014
	FREL submitted				Conditional	UNFCCC FREL
Colombia	Zero net deforestation in the Colombian Amazon		2020	2011-2020	Conditional	Alcobe 2014; Parker 2014
	Bonn Challenge Pledge of 1 million hectares		2020		Conditional	Bonn Challenge
	Initiative 20x20 Restoration of 1 million hectares		2020		Conditional	Initiative 20x20
	NYDF - halve natural forest loss by 2020 and end it by 2030	2014	2020 & 2030		Conditional	NYDF
	UNFCCC Submitted FREL				Conditional	UNFCCC FREL
Democratic Republic of the Congo	Bonn Challenge Pledge: 8 million hectares		2020		Conditional	Bonn Challenge
	FCPF ER-PIN 2020 tonnes			2015-2020	Conditional	FCPF ER-PIN
	NYDF - halve natural forest loss by 2020 and end it by 2030	2014	2020 & 2030		Conditional	NYDF
Ecuador	Increase to 300,000 ha the accumulated forest restoration area	2012	2017	2013-2017	Conditional	Alcobe 2014
	Initiative 20x20 Restoration of 500,000 hectares		2020		Conditional	Initiative 20x20
	UNFCCC Submitted FREL				Conditional	UNFCCC FREL
	NYDF - halve natural forest loss by 2020 and end it by 2030	2014	2020 & 2030		Conditional	NYDF

Table 2. Pledges and Commitments (cont)

Indonesia	Copenhagen Pledge - Reduce total GHGs 26% below BAU	BAU	2020		Unconditional	G of Indonesia 2010
	Post-Copenhagen Conditional Pledge - Reduce total GHGs 41% below BAU	BAU	2020		Conditional	G of Indonesia 2011
	LULUCF component of 26%: 80% of reduction from LULUCF	BAU	2020		Unconditional	Ministerial Speech
	LULUCF component of 41%: 80% of reduction from LULUCF	BAU	2020		Conditional	Ministerial Speech
	FCPF ER-PIN 2020 tonnes (excluded)	FREL	2020	2016-2020	Conditional	Indonesia ER-PIN
	FCPF ER-PIN 2026 tonnes	FREL	2026	2016-2026	Conditional	Indonesia ER-PIN
	FCPF ER-PIN 2030 tonnes	FREL	2030	2016-2030	Conditional	Indonesia ER-PIN
	NYDF - halve natural forest loss by 2020 and end it by 2030	2014	2020 & 2030		Conditional	NYDF
	Rio Branco Declaration: 6 Indonesian Provinces commit to 80% reduction in deforestation by 2020				Conditional	GCF 2014
	FREL submitted to UNFCCC				Conditional	UNFCCC FREL
Malaysia	Maintain 50% forest cover	none	all		Unconditional	UNFCCC NatCom
	UNFCCC Submitted FREL				Conditional	UNFCCC FREL
Mozambique	FCPF Preparation Grant signed (no targets)					
Myanmar	Double protected area to 10% of land area		2030-2031		Unconditional	Myanmar NFAP
Papua New Guinea	Copenhagen Pledge: Decrease GHG emissions at least 50% before 2030 and carbon neutral before 2050				Conditional	Climate Action Tracker
	27-38 MtCO2e reductions in forestry sector below BAU by 2030; 16-43 MtCO2e reduction in agriculture sector by 2030	BAU	2030		Conditional	Parker 2014
Paraguay	ZND in Atlantic Forest Region	none	Up to 2018		Unconditional	Paraguay ZND
Peru	FCPF ER Program		2020	2016-2020	Conditional	Alcobe 2014
	100% reduction in GHG emissions from LULUCF. (Parker et al word this as ‘zero deforestation in primary or natural forests by 2021’)	2000	2021	2012-2020	Conditional	Alcobe 2014; Parker 2014
	Initiative 20x20 Restoration of 3.2 million hectares		2020		Conditional	Initiative 20x20
	NYDF - halve natural forest loss by 2020 and end it by 2030	2014	2020 & 2030		Conditional	NYDF
	Rio Branco Declaration: 5 Peruvian States commit to 80% reduction in deforestation by 2020				Conditional	GCF 2014
Tanzania	40% of land area designated as wildlife and forest protected areas	none	none		Conditional	CBD NBSAP, CBD 5th Nat Com

FOREST AREA, EMISSIONS AND PATHWAYS BY COUNTRY

Brazil

Brazil is home to one out of every eight hectares of forest in the world, and about one of every four hectares of tropical forest. It is also home to one of every 10 hectares of global forest restoration potential, and one of every seven hectares of tropical forest restoration potential. Brazil's forests are also diverse geographically, ecologically, and in terms of threat: its forests form the core of three out of 11 global deforestation fronts (the Amazon, the Cerrado, and the Gran Chaco/Atlantic Forest). In short, no other country comes close to Brazil's importance in reversing the trend of tropical forest loss, protecting the world's critical forest habitats, and reaching a global ZND goal. At the same time, no other country comes close to Brazil's success in reducing deforestation in the last decade, even while expanding the agricultural production that was the largest driver of deforestation. By every measure, Brazil is an exceptional case.

Brazil's success to date is not accidental. It is the result of decades of effort (see above). The process of setting goals and making commitments has been part of this success, as evidenced by the 13 targets considered for this analysis (Table 2). Brazil's Forest Code, which sets the rules for how much forest private landowners are allowed to clear, has been an especially critical tool that will continue to influence the scale and type of forest protection and restoration actions in the future. For example, recent changes to the Forest Code have cut by more than half the area of forest 'owed' to the environment by out-of-compliance farms, as well as introduced new trading options that will allow farmers to reach compliance through deforestation reduction elsewhere rather than through on-farm restoration[47].

BY EVERY MEASURE, BRAZIL IS AN EXCEPTIONAL CASE. NO COUNTRY COMES CLOSE TO ITS IMPORTANCE IN REVERSING TROPICAL FOREST LOSS

The way Brazil does or does not collect the 20 million hectares restoration debt still owed by the private sector (and for that matter the choices Brazil makes about the additional 90 million hectares of forest loss that are legally allowed by the Forest Code[48]) is likely to have a larger impact than anything else on its ability to meet its goals and target[49].

We do not include these areas of owed restoration or allowed deforestation in the below analysis: these estimates require analysis of the expected impact of specific laws, and their enforcement on non-enforcement, which is beyond the scope of this analysis. Instead we focus at the stage of political leadership: the process of setting goals and making commitments has been part of Brazil's success to date; not least of which is evidenced by the 13 targets considered for this analysis (Table 2) and by the very fact that the deforestation legally allowed by the Forest Code exceeds the total forest loss area we calculate for Brazil's target pathway through 2030.

The following pledges, commitments, and targets were considered in the following analysis:

- National legislation: Reduce by 80% the annual deforestation rates in the Legal Amazon from the average between 1996 and 2005.
- Copenhagen pledge: Reduce deforestation in the Amazon to achieve 564 million tonnes CO2e reduction by 2020.
- National legislation: Reduce by 40% the annual deforestation rates in the Cerrado.
- Copenhagen pledge: Reduce deforestation in the Cerrado to achieve 104 million tonnes CO2e reduction by 2020.

- National legislation: Expand forest plantations by 3 million hectares (considered and excluded).
- Copenhagen Pledge: Reduce overall emissions 36.1 to 38.9% below BAU.
- Pacto para Mata Atlantica: Restore 15 million hectares by 2050.
- Bonn Challenge Pledge: Restore 1 million hectares of Mata Atlântica by 2020.
- Rio Branco Declaration: 6 Brazilian States committed to 80% reduction in deforestation by 2020.
- FREL: Brazil's forest reference emissions level submitted to the UNFCCC in 2014.

Gross deforestation area

BRAZIL'S REDUCTION OF DEFORESTATION IN THE AMAZON EXCEEDED ANY REASONABLY EXPECTED TRAJECTORY TO 2020

At the biome scale, Brazil's gross deforestation reductions to date have far exceeded any reasonably expected trajectory from the baseline to its 2020 targets. Brazil's target to reduce deforestation in the legal Amazon[50] by 80% by 2020 to 420,000 hectares was exceeded by only 9% in 2012 (457,000 ha), 40% in 2013, and by 15% in 2014. Deforestation in the Cerrado was lower than the 2020 target for the last four available years of data (2009-2012) according to MCTI statistics[51].

We construct a national-scale 2020 gross forest loss target for Brazil by combining the 80% Amazon target, the 40% Cerrado target, and a target of keeping forest loss stable at the 2003-2012 average for other biomes. This suggests a gross forest area loss target of 1.673 million hectares in 2020 (Figure 2, dashed blue line). At this national scale, Brazil's gross deforestation reductions still far exceed an expected glide path from the baseline period to its 2020 targets. In fact, some data sources suggest Brazil is already quite close to meeting this presumptive national-scale 2020 target: according to the MCTI data, gross deforestation was lower than 1.67 million hectares in all of the four latest available years (2009-2012), after a large drop from 3 million hectares in 2008. However, there is some indication that these last few years of MCTI data require validation: the Hansen forest cover loss data suggest more variability from 2008 to 2012, with a higher average gross cover loss of 2.873 million hectares per year.

Restoration and net deforestation area

We identified three restoration targets for Brazil, two of which appear to be overlapping (Table 2). The Bonn Challenge recognizes a pledge from Brazil of 1 million hectares of Atlantic Forest restoration by 2020 (a rate of 100,000 hectares per year from 2010 to 2020)[52], while the Atlantic Forest Pact (which includes 200 NGOs, governments, companies, and research centers) has set a target of 15 million hectares by 2050 (which would suggest a more ambitious 375,000 hectares per year from 2010 to 2050)[53]. The third target, established by regulatory decree (Decree No. 7390/2010, which regulates Brazil's National Policy on Climate Change), is to expand forest plantations by 3 million hectares by 2020 (300,000 hectares per year)[54]. In accounting for ZND, plantations are not equated with natural forests. We thus exclude Brazil's 3 million hectare target from the quantitative analysis of ZND (while recognising nonetheless that expanding forest plantations is likely to have significant carbon benefits).

How these targets compare to historical rates of forest restoration and recovery is less clear than forest area loss. While on a net deforestation basis, the FAO and Hansen data generally agree, they are quite different in the breakdown between gross forest

loss and gain. FAO data suggest a rate of about 119,000 hectares per year for 2001-2005 and 272,000 hectares per year for the next half-decade, which would include restoration or reforestation of natural forests as well as establishment of plantations. Hansen data suggest a much greater area of forest cover gain of about 642,000 hectares per year between 2001 and 2012. This would include recovery of natural forest cover after disturbance, reestablishment of forest plantations after harvest, and expansion of forests (both natural and plantation) into previously un-forested areas.

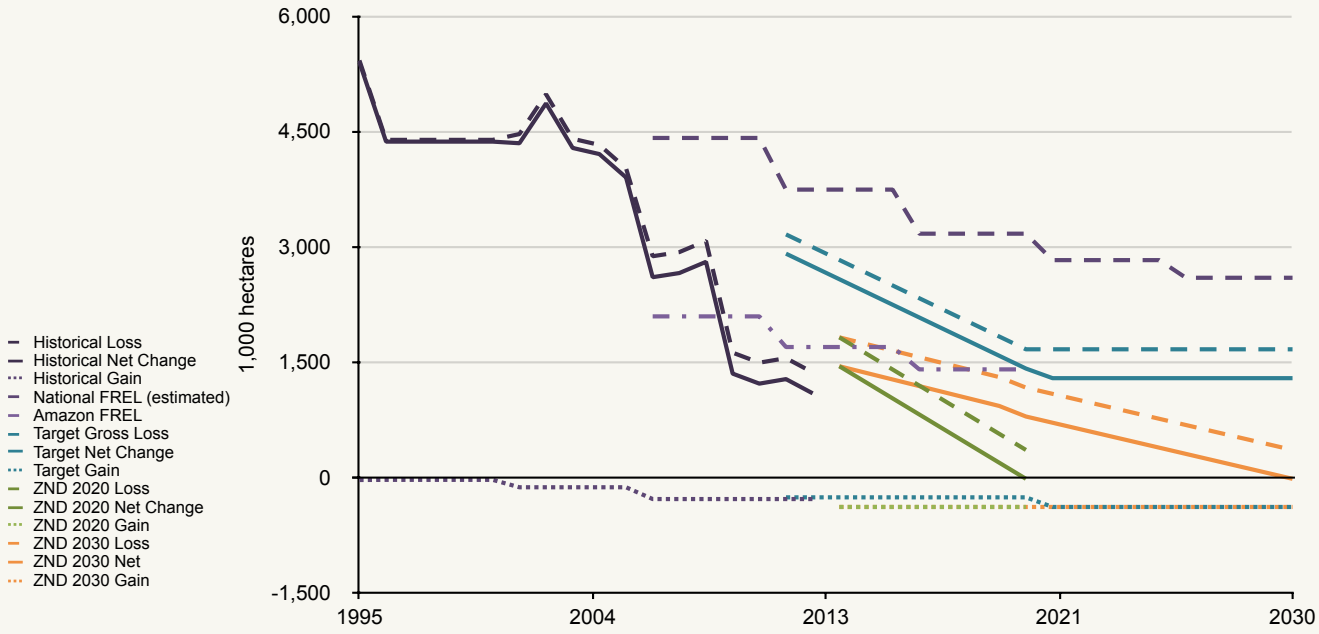
1.42 MILLION

BRAZIL'S CURRENT SET OF TARGETS ADD UP TO LEAVE IT'S PROJECTED NET FOREST AREA LOSS AT 1.42 MILLION HECTARES IN 2020

We take from these high levels of historical forest area recovery that the 100,000 hectare Bonn Challenge pledge is likely to be on the low side. We also recognise that restoration by parties to the Atlantic Forest Pact is likely to ramp up over the 40-year period rather than hit the 375,000 hectare per year goal in the first decade. So it potentially overstates the level of restoration pledged by 2020. As a result, we set the most likely interpretation of Brazil's current forest restoration target at 250,000 hectares per year between 2010 and 2020 (Figure 2, dotted blue line), two thirds of the Atlantic Forest Pact annual average. We assume this increases to the full rate of 375,000 ha per year in 2021 for the next decade[55].

Combining this restoration target with the presumptive national-scale gross forest loss target calculated above, we estimate that Brazil's current set of pledges, commitments, and goals sum to a 2020 net forest area loss target of 1.42 million hectares per year (Figure 2, solid blue line). This target is 66% less than the net deforested area in 2000; but Brazil's very strong success in reducing forest loss in the last decade makes this future seem short on ambition in relative terms: official statistics suggest that this target has already been surpassed.

Figure 2. Brazil's historical forest area change and targets.



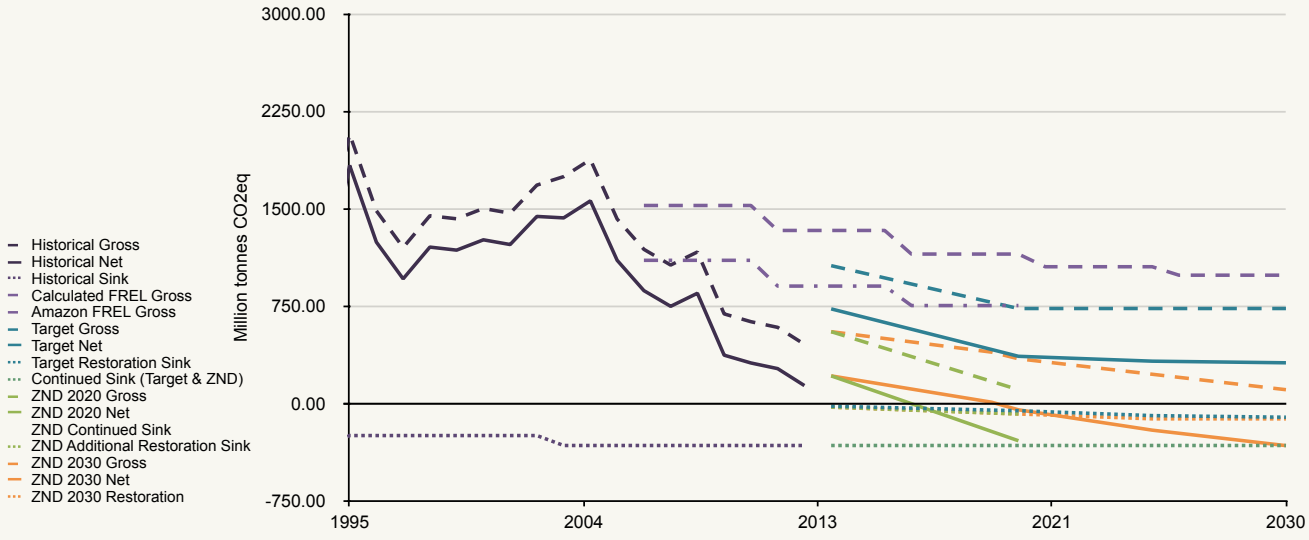
A ZND goal by 2020 would require more aggressive targets. For example, if Brazil committed to 375,000 hectares per year of natural forest expansion, and set a goal of an 80% further decline in gross deforestation in all biomes from the 2008-2012 average, it would reach zero net deforestation (or even become a net reforesting country) by 2020. This level of natural forest loss in 2020 would certainly meet the ZND criteria of 'near zero' – it would be equivalent to a rate of 0.07% per year of Brazil's total forest area, or 0.08% of Brazil's primary forest area – 8 hectares per year lost out of every 10,000 ha, offset by ecologically sound restoration elsewhere. A more gentle ZND-2030 glide path was also modelled (Figure 2, orange), using the same combination of criteria but with a 2030 target date (80% decline in gross deforestation for all biomes below 2008-2012 average, 375,000 hectares per year of restoration).

Deforestation emissions

Of course forest area and cover are not the whole story: it is the climate impact of forest loss that is driving much of the near term pressure to raise the ambition of forest sector targets. As discussed above, meeting the ZND goal on an area basis does not translate into zero net emissions – forests could be a net zero emissions if forest area is stable, but could also be a significant source or sink.

So how do Brazil's targets stack up in terms of emissions? In national legislation, Brazil has committed to cutting gross deforestation emissions from the legal Amazon[56] by 564 million tonnes CO2e per year by 2020 from the 1996-2005 average of 1,084 million tonnes (60%). In the Cerrado it has committed to cuts of 104 million tonnes per year by 2020 from the 1999-2008 average of 323 million tonnes CO2 per year (32%). And it has committed to keeping emissions from rising above 133 million tonnes CO2 per year in other biomes[57]. Together, these sources result in a 2020 gross deforestation emissions target of 736 million tonnes CO2 (Figure 3, dashed blue line). It is not clear why Brazil's targets for the Amazon and Cerrado are more ambitious on an area basis (80% and 40% respectively) than on an emissions basis (60% and 32%).

Figure 3. Brazil's historical forest emissions and targets.



A few additional steps are needed to assess the net emissions implications of Brazil's targets taken together. First, we estimate the additional sequestration from 250,000 hectares per year of restoration by assuming 20 tonnes CO2 of sequestration per hectare per year, yielding a sink in 2020 of 50 million tonnes CO2 per year (Figure 3, dotted blue line). Second, we assume that Brazil's natural forest carbon sink continues at the same level as recent decades (Figure 3, dotted blue-green line)[58]. Together these sinks, when added to Brazil's target 2020 gross deforestation emissions, result in an overall 2020 target net deforestation emissions of 368 million tonnes CO2 (Figure 3, solid blue line).

We also estimate the potential emissions impact of our ZND scenarios using a bottom-up analysis of deforestation emissions from each biome, and similar sequestration estimates as the 2020 target (but with the higher level of 375,000 hectares per year of restoration). For the ZND-2020 pathway, Brazil's forests are a net carbon sink of 280 million tonnes CO2 per year in 2020 while at net zero deforestation in area terms (Figure 3, solid green line). The sink is slightly larger (320 million tonnes CO2 per year, Figure 3 solid orange line) in 2030 with the ZND-2030 pathway, due to a greater cumulative restoration area.

IF BRAZIL ACHIEVED ZND-2020, ITS FORESTS WOULD BE A NET CARBON SINK OF 280 MILLION TONNES CO2 PER YEAR IN 2020

Pledges: unilateral vs conditional

Brazil's core deforestation reduction and restoration targets have been put forward primarily as conditional upon provision of international finance. While gross deforestation reduction targets for the Amazon and Cerrado, and the expected emissions reductions they will achieve, are included in national legislation, the legislation explicitly includes conditionality on finance[59]. In the context of the UNFCCC, the same targets are inscribed as potentially financed: 'Use of CDM is not excluded.'

The best indication of Brazil's intended level of conditional or funded reductions is the difference between its 2020 target and the forest reference emissions level (FREL) it submitted to the UNFCCC[60]. For the purposes of international REDD+ payments, it proposed a 'dynamic mean' approach to setting its FREL by averaging from 1996 through the end of the previous five-year period (e.g., 1996-2005 average for 2006-2010); and starting with the scope of gross deforestation emissions from the Amazon biome. If Amazon biome deforestation remains at the average 2011-2014 level (about 540,000 hectares lost per year), then the 2020 FREL would be 758 million tonnes CO2 from Amazon biome deforestation, compared to their target of 384 million tonnes CO2. This suggests that, for the Amazon biome, Brazil is seeking international finance for 375 million tonnes CO2 reductions per year in 2020, which may increase as it expands the FREL to include additional biomes and potentially to degradation as well as deforestation.

How much of its planned 2020 target is considered self-financed is more a philosophical (and ultimately political) question than an analytical one – it would be the difference between the 758 million ton FREL in 2020 and a counterfactual 'business-as-usual' scenario for 2020. The 2020 FREL is 45% below the 2003-2004 peak of 1.38 Gt from Amazon deforestation; if this were the 'business-as-usual' baseline level, then Brazil is proposing to self-financed close to two-thirds of its reduction while asking the international community to finance a third. On the other hand, the FREL is almost three times higher than the 2012 low point of 263 million tonnes; if one assumes this achievement is a 'new normal,' then a rise of more than 100 Mt to the 375 million ton target followed by a payment for 375 million tonnes between the target and the FREL might seem questionable.

Box 3

Impact of sub national and supply chain commitments on Brazilian target

Sub national:

The Rio Branco declaration was signed by six Brazilian states (Acre, Amapa, Amazonas, Mato Grosso, Para, and Tocantins), each of which pledged an 80% decrease in deforestation by 2020 with the provision of adequate finance[61]. All of these states are part of the Amazon, for which there is a national 80% by 2020 target. The state-level commitments are certainly important – some would argue much more important than national commitments, as they are closer to the political level at which land use decisions are made. However important they may be for successful implementation, the question for this analysis is more whether they suggest greater ambition overall in the existing set of targets than the national-level 80% commitment.

Generally speaking, they may: if strong success in some states does not give others leeway to go below the 80% Amazon-wide target, then greater reductions will be achieved. However, this potential is difficult to quantify without a large number of assumptions. So we recognise the ambition of the states signing the Rio Branco declaration, but we do not include a quantitative estimate of the potential for additional reduction beyond the existing Amazon region national pledge.

Amazon deforestation for beef and soy and supply chain commitments:

Most Amazon forest conversion in recent decades has been for production of beef and soy. Grieg-Gran et al. (2007) estimate that 76% of the forest area lost in the Amazon between 1995 and 2005 was lost to cattle pasture, and another 17% was lost initially to soy production (93% total for the two commodities)[62]. A more recent INPE study (2011) found that some of this converted forest is eventually abandoned: of the cumulative area of forest lost in the legal Amazon by 2007, at least 63% was being used as cattle pasture in 2008 and at least 5% for crops, while 21% was 'secondary vegetation' that may have been cleared for agriculture and has since begun to regrow[63]. A recent literature synthesis estimated 2000-2012 deforestation in Brazil due to commercial agriculture at 90%[64].

Much of the decline in Amazon deforestation since 2005 has been credited to supply chain actions – most notably the Soy Moratorium and the G4 Cattle Agreement[65]. If one assumes that these or other similar agreements (such as the NYDF or the CGF pledge) targeting zero deforestation will be in effect for all companies involved in the soy and beef supply chains in the Amazon in 2020, then Brazil's target of an 80% reduction would fall well below the 93% reduction such commitments would suggest based on the Grieg-Gran estimates. So all else being equal, universal zero-deforestation supply chain commitments across all beef and soy producers in the Amazon would prevent the loss of about 210,000 hectares of forest (10% of the 1996-2005 average of 2.1 million) beyond the current 80% Amazon reduction pledge in 2020.

The difference is much greater for the Cerrado: if all soy and beef producers in the Cerrado were subject to zero deforestation commitments in 2020, then a 90% cut from the 1.5 billion hectare baseline protects about 740,000 more hectares than the government-pledged 40% decline. If included in our analysis of existing pledges, an expansive interpretation of these voluntary corporate commitments – one that assumes all companies involved in soy and beef production and trade are subject to and meet voluntary zero-deforestation pledges – would suggest that Brazil's current 2020 target is 473,000 hectares net forest area loss in 2020 –much lower than the 1.42 million hectares net we estimate above without considering supply chain commitments. In terms of emissions, given the extent of Brazil's forest area, even this level of net forest area loss would likely result in Brazil's land use sector becoming a net carbon sink.

There is strong but limited evidence emerging that zero deforestation supply chain commitments change behavior on the ground and reduce deforestation[66]. However, the reduction is not yet complete: there are loopholes, incomplete tracking, and incomplete compliance. Thus, while noting the importance of these supply-chain commitments, and the strong potential for them to achieve even greater reductions in forest loss than the Brazilian government's national and sub national targets, we do not include them in the full analysis with the full rigor we apply to the pledges and targets of sovereign nations.

Key insights: Brazil

- To achieve zero net deforestation, Brazil needs to eliminate another million hectares of net forest area loss from the 2012 level. Its 2020 targets, however, allow more loss than this level. It is a political rather than scientific question whether this dissonance reflects massive success in cutting deforestation from earlier peaks to now, insufficient ambition in 2020 and beyond, or some combination of the two.

- To achieve zero net emissions, deforestation emissions may have already fallen to the point where they are extremely close to being balanced by Brazil's forest sink from both restoration and from sequestration in healthy forests. Whether this is the case depends critically on the relative health versus degradation of Brazil's standing forests. Better data are needed to reach clear consensus on degradation emissions – and thus the potential for additional sequestration through avoided degradation.

- Significantly more ambitious targets would be needed to achieve ZND in Brazil by 2020 or 2030. For example, an 80% cut in deforestation area from the 2008-2012 average in all biomes, combined with 375,000 hectares per year of restoration. If ZND were achieved on either timeline, Brazil's forests would likely become a significant carbon sink.

- While difficult to synthesise at the national scale, sub national and private sector pledges provide important signals of political buy-in from key stakeholders, indications of where and how national-scale pledges might be achieved, and potentially greater ambition than national government pledges in themselves.

Indonesia

Indonesia's forests form the heart of one of the world's three core tropical forest zones. They are hyper-diverse, providing habitat to some of the Earth's most critically endangered forest-dwelling species. They are also massively threatened. Three of the world's 11 zones of likely future deforestation include Indonesian forests: Borneo, Sumatra and New Guinea. And while its forest area is less than one-fifth of Brazil's, it is losing tree cover at a faster rate[67], losing more primary forest than Brazil per year since 2012[68]. By most accounts has for several years surpassed Brazil to become the world's largest forest and land use emitter (e.g. FAOStat and national reporting).

In Indonesia, belowground carbon emissions from peat drive an unusual decoupling between forest area loss and land use emissions. The aboveground carbon density of Indonesia's peat forests is substantial, but lower than many other tropical forests. However, Indonesia's peat forests store an order of magnitude more carbon below ground. This additional carbon is usually lost eventually when the forest above is cleared – either immediately through fires, or slowly through decomposition. Indonesia could slash emissions significantly by avoiding forest loss, draining, and fires on peat lands – even while maintaining a substantial overall rate of forest area loss. For example, our analysis of Indonesia's proposed UNFCCC FREL[69] suggests that the country could slash forest and land use emissions by 80% below business as usual to meet its 41% conditional Copenhagen commitment, with no decline in forest area loss. The implication for this study is that we must decouple our analysis of forest area and forest emissions targets.

The following pledges, commitments, and targets were considered in the following analysis[70]:

- Copenhagen Pledge: Reduce total GHGs 26% below 'business-as-usual'.
- Post-Copenhagen Conditional Pledge: Reduce total GHGs 41% below 'business-as usual'.
- Forest and Land Use component of Copenhagen 26% Pledge: 80% of overall reduction from LULUCF.
- Forest and Land Use component of Post-Copenhagen 41% Pledge: 80% of overall reduction from LULUCF.
- Forest Carbon Partnership Facility Emissions Reduction-Program Idea Note (ER-PIN): Target reductions in 2020, 2026, and 2030 (excluded).
- NYDF: Halve natural forest loss by 2020 and end it by 2030.
- Rio Branco Declaration: six Indonesian Provinces commit to 80% reduction in deforestation by 2020.
- FREL: Indonesia's draft forest reference emissions level released in 2015.

Gross deforestation area

OVER HALF OF INDONESIA'S FOREST COVER IS FOUND IN THE SIX PROVINCES THAT ARE PART OF THE GOVERNORS' CLIMATE AND FORESTS TASK FORCE

About 58% of Indonesia's total 2012 forest cover is found in the six provinces that participate in the Governors' Climate and Forests Task Force and signed the Rio Branco Declaration — Aceh, Central Kalimantan, East Kalimantan, West Irian Jaya (West Papua), West Kalimantan, and Papua[71]. These provinces have larger areas of intact primary forest, and less plantation forestry, than the average Indonesian province; therefore lower rates of tree cover loss and gain are found in these provinces (41% and 32%, respectively) than would be expected based on proportional forest area.

While these tree cover-based proportions estimates are imperfect as measures of natural forest loss, they allow us to scale the potential impact of the Rio Branco declaration pledges on the national-scale target. If natural forest loss were distributed across provinces in equal proportion to forest cover, then an 80% cut applied to the 58% of forest cover in the Rio Branco Provinces would suggest a 46.4% cut to Indonesia's total natural forest area loss (if no cuts were achieved outside these provinces). If distributed in proportion to observed forest cover loss rather than forest cover, than the 80% Rio Branco target would translate into a 32.7% cut in national forest loss (again, all other things being equal). We use this estimate as a lower bound for Indonesia gross forest loss reduction target in 2020, compared to the historical average from 2001 to 2012 of national deforestation area as expressed in its recent FREL proposal to the UNFCCC.

As in the case of Brazil, from an accounting perspective these targets may or may not achieve greater impact than a national-level target – in this case, the 50% reduction in natural forest loss as suggested by Indonesia's signing the New York Declaration on Forests. However, the 50% NYDF target is global. Signatories pledged to work in partnership towards this and other outcomes with 'varying mandates, capabilities, and circumstances'.

The sub national pledges by the Rio Branco provinces provide a foundation for interpreting the 50% NYDF target as a higher end estimate of Indonesia's forest loss

reduction target in 2020. Projecting forward to 2030, the NYDF zero natural forest loss target clearly dominates. Both pathways are included in Figure 4 below for illustration; the more ambitious interpretation of the NYDF as applying at national scale and Rio Branco pledges are used for the remainder of the analysis.

Restoration and net deforestation area

The data and signals on forest restoration in Indonesia are unclear. We take as our primary estimate of historical forest gain the 'average rate of forest establishment between 1996 and 2006' of 198,000 hectares per year reported by the Ministry of Forestry in its 2010-2014 Strategic Plan (Indonesia's SNC)[72]. However, it is not clear what types of forests are included in this rate (natural vs plantation). Hansen et al estimate an average annual forest cover gain from 2000 to 2012 of almost three times this rate (581,000 hectares per year), which does include plantation forests as well as restoration and natural regeneration – suggesting that the lower rate may be in line with natural forest establishment and recovery.

There is significant degraded land potentially available for restoration in Indonesia – as much as 62 million hectares in total, only one third of which is agricultural land[73]. This is about 2% of global restoration potential.

However, Indonesia has not joined the Bonn Challenge formally, nor has it set other clear forest restoration targets. The only signal from the government of its intention to achieve any large scale forest restoration is found in the mitigation measures section of Indonesia's SNC – which lists a planned rate of planting for the 11 years from 2010 to 2020 for different types of forests from the Ministry of Forestry's Strategic Plan. The rate of planned restoration of natural forests fluctuates between 300,000 and 750,000 hectares per year, averaging 523,000 hectares per year, relying on private sector and international funding. This is on top of a similar planned rate of planting funded by the private sector in forest plantations; a similar rate of government-financed planting of community forest (primarily plantations rather than natural forest); and a significant area of planting for watershed rehabilitation and partnership forests (of unclear type).

The total 21.15 million hectares of proposed planting by 2020, at a rate of over 1.9 million hectares per year, is probably higher than is likely to be achieved. Thus, we take this table less as a 'pledge' and more as a signal that the government recognises the significant potential for replanting, and that the Ministry of Forestry would welcome significant international finance for natural forest restoration activities. We choose to use the benchmark of 198,000 hectares of historical forest establishment as Indonesia's planned natural forest restoration amount, noting that this could in fact be quite aggressive if the historical rate is based primarily on establishment of plantation forests.

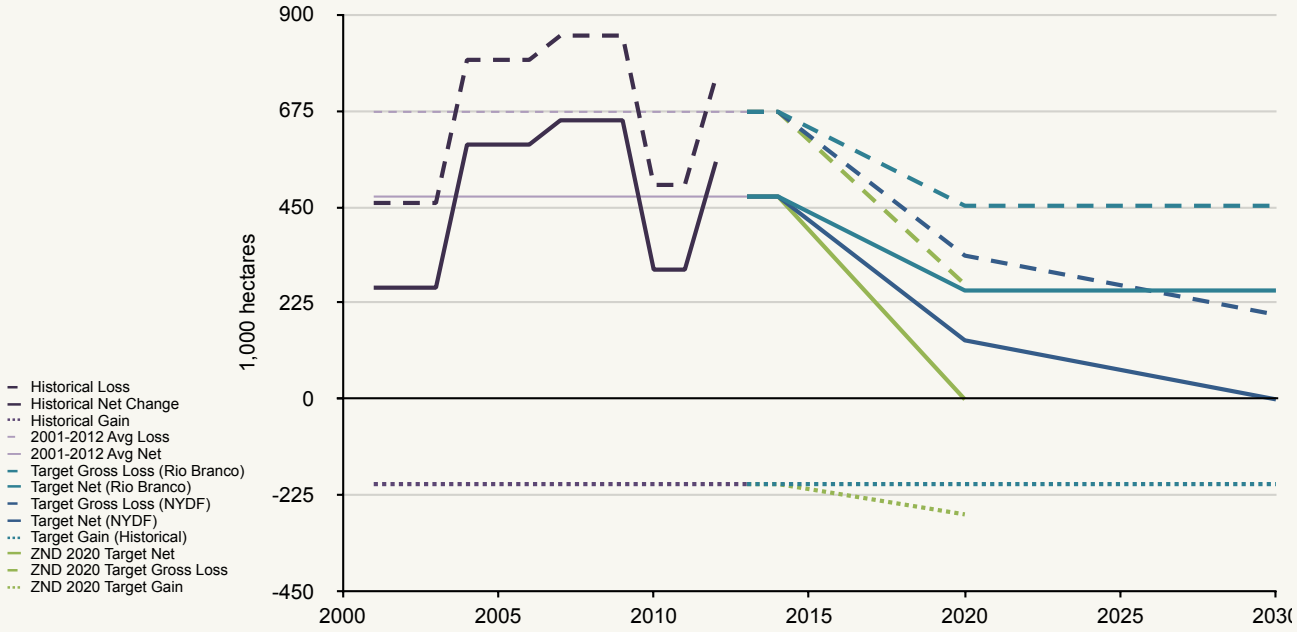
138,000

REMAINING HECTARES OF FOREST LOSS IN INDONESIA IN 2020 UNDER MOST AMBITIOUS INTERPRETATION OF NATIONAL TARGETS

Indonesia's overall forest area target is thus modeled as a range. Combining the Rio Branco forest loss reduction estimate of 32.7% (dashed light blue line) with the planned natural forest restoration of 198,000 hectares per year (dotted light blue line) yields an estimated net forest area loss of 254,000 hectares in 2020 (solid light blue line below) – a 46% cut in net forest loss from the 2001-2012 average. At the more ambitious end, a 50% cut in natural forest loss by 2020 (per the NYDF, dashed dark blue line), combined with the same restoration rate, yields an estimated net forest area loss of 138,000 hectares per year, or a 70% reduction from the 2001-2012 average (solid dark blue line).

There is not much farther to go (from a pledging perspective) for Indonesia to approach ZND by 2020: increasing the forest loss target from a 50% cut in 2020 to a 60% cut in 2020 (dashed green line), and ramping up restoration by an additional 70,000 hectares per year from the current planting rate (dotted green line) achieves ZND by 2020 (solid green line) at a rate of gross forest loss of between 0.2% and 0.3% per year. The NYDF pledge of zero natural forest loss by 2030 clearly achieves ZND-2030. If this is pursued on top of 198,000 hectares of natural forest restoration per year, then Indonesia's 2030 zero net forest loss could be achieved at gross deforestation rates of around 0.2%.

Figure 4. Indonesia's historical forest area change and targets.



Deforestation emissions

There is extreme variability in different estimates of Indonesia's land use emissions[74], driven to a large extent by the uncertainty in peat emissions. As our objective is to assess the potential impact of Indonesia's existing targets and commitments on 2020 and 2030 land use, land use change and forestry (LULUCF) emissions, we use the same categories and estimates as used by the government in its communications to the UNFCCC (SNC, UNFCCC FREL) when possible. In its draft FREL, Indonesia included aboveground biomass (AGB) and peat decomposition emissions from both deforestation and degradation occurring on forest land (Table 2, light grey). Peat decomposition on non-forest land was excluded (medium grey), as was peat fire emissions from forest and non-forest land (dark grey), due at least in part to low precision in estimating and monitoring such emissions.

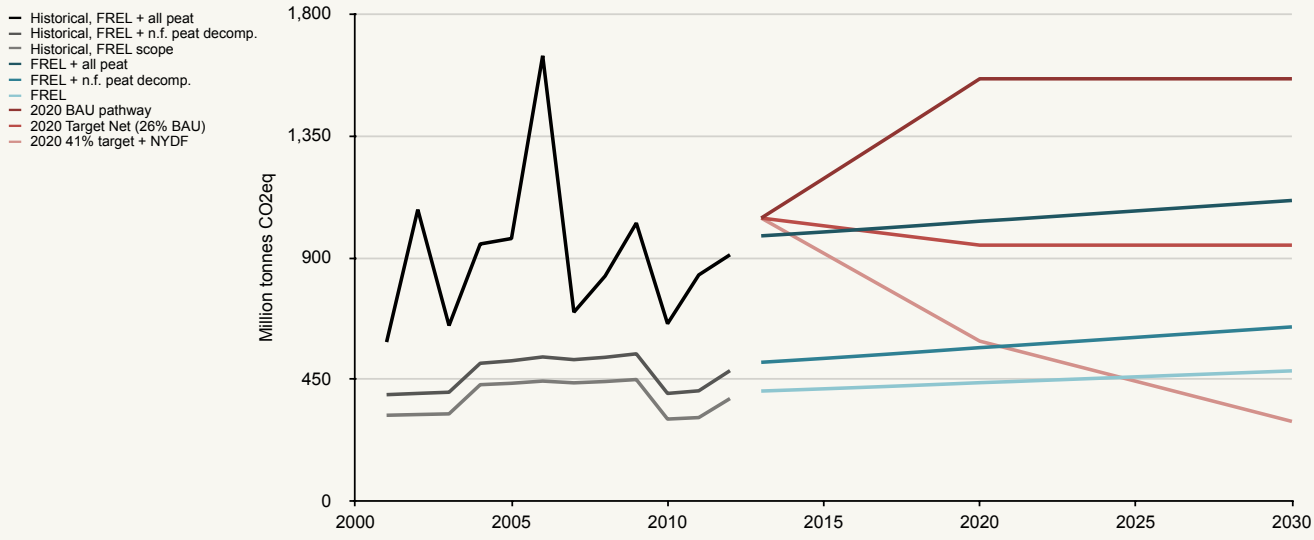
Table 2. Scope of emissions in Indonesia's draft FREL

	Forest	Non-Forest
Mineral Soils	Deforestation – AGB Degradation – AGB	NA
Peat Soils	Deforestation – AGB Degradation – AGB Deforestation – Peat decomposition Degradation – Peat decomposition	Peat decomposition
	Peat fires	Peat fires

For this analysis, we follow Indonesia's categorization and estimate emissions for each. Historical estimates of AGB and peat decomposition in forest areas are from the draft FREL (Figure 5, light grey), averaging 384 million tonnes for 2001-2012. On top of the FREL, we add historical peat decomposition emissions in non-forest areas estimated very roughly at about 90 million tonnes per year by assuming constant per-hectare emissions factors across land cover classes, applied to the area of forested vs non-forested peat soils as estimated in the SNC (8.5 million hectares and 6.4 million hectares respectively, Figure 5, dark grey). Finally, we add to these the same estimate of peat fire emissions that the government uses in its draft FREL for 1997-2007 (van der Werf, 2007), extended to 2012 using a linear model from the highly correlated UNEP estimates of Indonesia's LULUCF emissions (black). This adds an average 440 million tonnes per year, ranging from a low of 170 million tonnes to a high of 1.2 gigatonnes[75].

We use the same methodology looking forward from 2013 for three FREL pathways. The draft FREL hits 439 million tonnes in 2020 for the categories it includes (Figure 5, light blue). With linear growth until 2030 it hits 483 million tonnes. Expanding this to include non-forest peat decomposition as a constant multiple of the FREL-estimated forest peat decomposition increases this by 129 million tonnes per year in 2020 and 162 million tonnes in 2030 (medium blue).

Figure 5. Indonesia's historical forest emissions and targets.



Adding the average peat fire emissions from 1997-2007 of 466 million tonnes, as was done in Indonesia's SNC (dark blue), yields a total of 1.03 gigatonnes in 2020 and 1.11 gigatonnes in 2030. Next, we step from this historical baseline estimate to a business as usual pathway using a linear increase to the 2020 value as estimated by Indonesia in its SNC of 1.56 gigatonnes (dark red). Finally, we estimate Indonesia's target LULUCF emissions pathways assuming 80% of planned reductions would come from the land use sector to meet its Copenhagen commitments of 26% (medium red) and 41% (light red). This yields estimated 2020 targets for LULUCF emissions of 946 and 592 million tonnes respectively. We extend these 2020 levels out to 2030, noting that the 600 million tonne per year emissions level suggested by the 41% target could in fact be realised even if forest area loss were cut all the way to zero by 2030, as in the NYDF.

Unilateral vs conditional

The clear division between unilateral and conditional action embodied in Indonesia's dual 26%/41% Copenhagen pledge is a model of clarity that should be replicated by other developing countries[76]. Furthermore, while Indonesia's historical emissions are quite uncertain, and are a complex mix of different categories, the government of Indonesia has clearly communicated its understanding of both historical and business as usual emissions scenarios, as well as the planned categories and methodological approach for its FREL. These 2020 targets and reference levels are compared explicitly for 2020 in Figure 6.

Figure 6. Indonesia's 2020 targets, comparing FREL to Copenhagen Pledge.

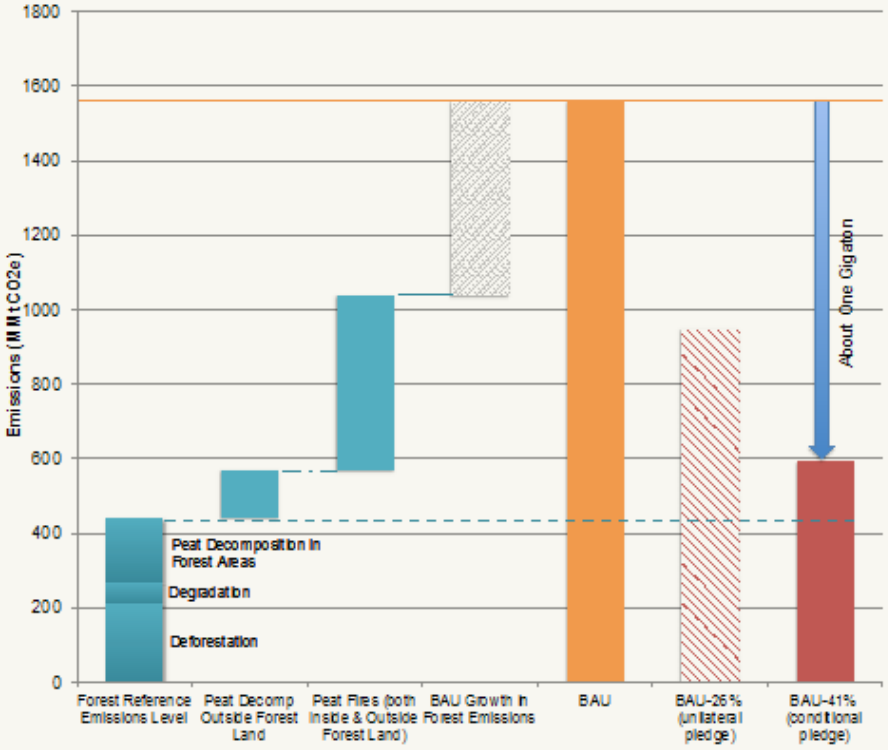


Figure 6 Notes: Forest Reference Emissions Level: As submitted in December 2014; equals 439 Mt, consisting of 210 Mt AGB from deforestation, 57 Mt AGB from degradation, and 172 Mt peat decomposition within the FREL area. Peat Decomposition Outside Forest Lands: As calculated in text, (129 Mt). Peat Fires: As assumed for BAU 2020 peat fire emissions in Indonesia's Second National Communication (470 Mt, significant uncertainty). BAU Growth in Forest Emissions: The difference between the FREL approach and the BAU estimate, consisting approximately of BAU growth in forest and grassland conversion and peat decomposition. BAU: Projected 2020 BAU emissions from LUCF+Peat Fires of 1560 Mt, from Indonesia's SNC. BAU-26%: The BAU emissions, minus 80% of a 26% reduction from Indonesia's total projected BAU emissions of 2.9 Gt in 2020 (670 Mt reduction). BAU-41%: The BAU emissions minus 80% of a 41% reduction from Indonesia's total projected BAU (1 Gt).

Box 4

Impact of supply chain commitments on Indonesia's forest loss

Expansion of palm oil plantations in Indonesia is one of the world's largest single drivers of tropical forest habitat loss and land use change emissions[77]. Lawson (2014) estimates that on an area basis, 81% of Indonesia's deforestation is related to commercial agriculture, including 36% for oil palm and 24% for timber plantations. In less than two years, there has been a revolution in the way private sector palm oil producers, traders, and consumer-facing users are approaching deforestation in the sector – with over 90% of traded palm oil and 80% of production now covered by zero-deforestation, zero-fire, and zero-peat loss pledges[78], and with growing capacity and buy-in for implementing these commitments.

These private sector commitments by the palm oil sector could suggest more stringent 2020 targets than Indonesia's national-scale commitments, both in terms of forest area loss and in terms of emissions. Eliminating the 36% of Indonesia's forest area loss from palm oil would be a slightly more aggressive target than the sum of Rio Branco states' 80% pledges. From an emissions standpoint, palm plantation expansion on Borneo alone has been projected to contribute up to 550 million tonnes of CO_2 emissions by 2020[79]. The private sector no-peat development pledge alone would exceed Indonesia's current targets: 75% of Indonesia's 2000-2012 LULUCF emissions are peat-related. If palm oil development were responsible for only 36% of this total, then diverting such development away from peat would eliminate around 244 million tonnes of emissions per year. Eliminating 36% of Indonesia's AGB emissions from deforestation on mineral soils achieves another 80 million tonnes.

Taken together, reducing emissions 320 million tonnes per year below the historical level in 2020 would be significantly more than the reduction suggested by Indonesia's 26% below business-as-usual unilateral pledge. This would achieve fully 75% of the planned forest-sector portion of Indonesia's 41% pledge.

Key insights: Indonesia

- There is significant uncertainty in the analysis of both area and emissions targets, most notably on current levels of forest area restoration or recovery; the size of Indonesia's forest sink; whether some estimates by the government are net or gross of this sink; the emissions from peat decomposition and fires; and the extent to which Indonesia has embraced specific domestic forest area loss targets.

- By our assessment, if Indonesia meets 80% of its unilateral Copenhagen target of 26% below business-as-usual through action in the forest and land sectors, it will achieve a reduction from an historical baseline. A similar approach to its 41% target (again based on business as usual) would require a cut of more than 40% below historical emissions in the sector.

- Indonesia's forest area loss targets (as interpreted from the Rio Branco declaration and/or the NYDF) are decoupled from its emissions targets. It could fully achieve its emissions targets by substantially curtailing peat fires while maintaining the same level of forest area loss. It could also entirely eliminate forest area loss, and see emissions increase if peat fires and peat decomposition accelerate from the historical average. To achieve clarity on intent for its forests, Indonesia should set both forest area loss targets and emissions reduction targets.

- The potential reductions in both forest area loss and land use emissions resulting from successful implementation of private sector pledges could significantly exceed government targets.

Democratic Republic of the Congo

The Democratic Republic of the Congo (DRC) houses more tropical forest than any other country on Earth except Brazil – about 150 million hectares – most of it still intact primary forest. Its rate of forest area loss has been low – about 0.2% per year from 2000 to 2010 (FAO, GoDRC). Decreasing this low level of deforestation – or even maintaining it – will be difficult in the face of significant development needs and pressures from slash and burn agriculture, wood energy and charcoal production, bushfires and logging (according to DRC's ER-PIN – emissions reduction program idea note).

One clear government strategy is to divert economic activity away from primary forests by restoring degraded lands into more sustainable forestry and agroforestry uses. At the 2014 UN Secretary General's Climate Summit, DRC announced a new pledge to initiate 8 million hectares of forest restoration by 2020 – an audacious pledge, but not impossible given its 93 million hectares of potential restoration area[80]. DRC also joined the NYDF, pledging to play its part in halving the rate of loss of natural forests globally by 2020. A third signal of ambition comes from DRC's proposal to the Forest Carbon Partnership Facility Carbon Fund (ER-PIN)[81]. The proposal covers the 12.3 million hectare Mai Ndombe region, about 5.4% of the country's land area, and seeks to reduce deforestation emissions from the region in the range of 20-40%.

IN 2014, THE DRC PLEDGED TO INITIATE 8 MILLION HECTARES OF FOREST RESTORATION BY 2020

We follow the lead of the government of DRC, as expressed in its detailed ER-PIN, in our choice of data sources and methodology to quantify DRC's historical and target forest loss and emissions. These include:

- using Hansen et al 2013 as the primary historical dataset;
- using a 50% forest cover threshold for defining 'forest' and dividing such forest into primary (75% and up) and secondary (50-75%) categories;
- applying emissions factors for deforestation of primary and secondary forest of 800 and 441 tCO2/ha, respectively; and
- using of a 10-year mean carbon removal of 10.7 tCO2/ha/year for afforestation and reforestation of natural forests.

We also use DRC's estimate of forest and land use sequestration from its Second National Communication to the UNFCCC[82], and we use the generally constant proportional relationship between sequestration and forest cover (averaging about 3 tonnes CO2/ha/yr) to estimate sequestration at any given level of forest cover. Taking note of DRC's adjustment factor of about 20% in its ER-PIN baseline to account for the pressures facing a high-forest-cover, low-deforestation (HFLD) country, we model the 50% by 2020 NYDF pledge using a linearly increasing business as usual baseline rather than a flat historical average. Finally, we assume that the DRC's Bonn Challenge pledge targets natural forest restoration at a constant rate of 1.3 million hectares per year from 2015-2020.

This approach yields several results. DRC's existing targets far exceed ZND-2020. The Bonn Challenge pledge dominates this result: 1.3 billion hectares of restoration per year in 2020 is more than double the 2020 business as usual of 580,000 hectares of gross forest area loss. If this business as usual forest area loss were halved, as suggested by DRC's NYDF endorsement, then restoration would be more than four times the level of the gross loss. In fact, in this case 2020 gross deforestation of around 300,000 hectares would be about 0.2% of DRC's forest area, so ZND 2020 could be considered met even if DRC were only able to reach a restoration target of 2,000,000

hectares by 2020. If forest area gains return to the recent historical level after meeting the 2020 restoration target, then the NYDF 2030 target of zero deforestation dominates the pattern of forest area change for next decade, reaching zero with 116,000 hectares of natural forest recovery or replanting balancing out the same amount of gross forest loss, which is less than 0.1% of DRC's natural forest area. From an emissions perspective, DRC is already a net sink. However, this result is subject to considerable uncertainty in large part based on the scope of emissions considered and the data source used. Sources that use fire data as a proxy for land use emissions, such as EDGAR, suggest that DRC would still be a net source in 2020 even with a 50% cut in gross deforestation and 1.3 million hectares per year of restoration[83].

Key insights: DRC

- DRC is seeking to achieve very significant reduction and reversal of net forest loss by 2020, with an aggressive and clearly defined forest restoration objective dominating an overall target that far exceeds ZND by 2020.
- Targets in gross deforestation reduction are less well-defined, but DRC has signalled that it seeks cuts both through its UNFCCC FREL and it's signing of the NYDF.
- DRC's forest emissions targets are least well defined, with the relationship between emissions and area-based targets complicated by the treatment of emissions from forest fires.

Figure 7. DRC's historical forest area change, business as usual, and target pathways.

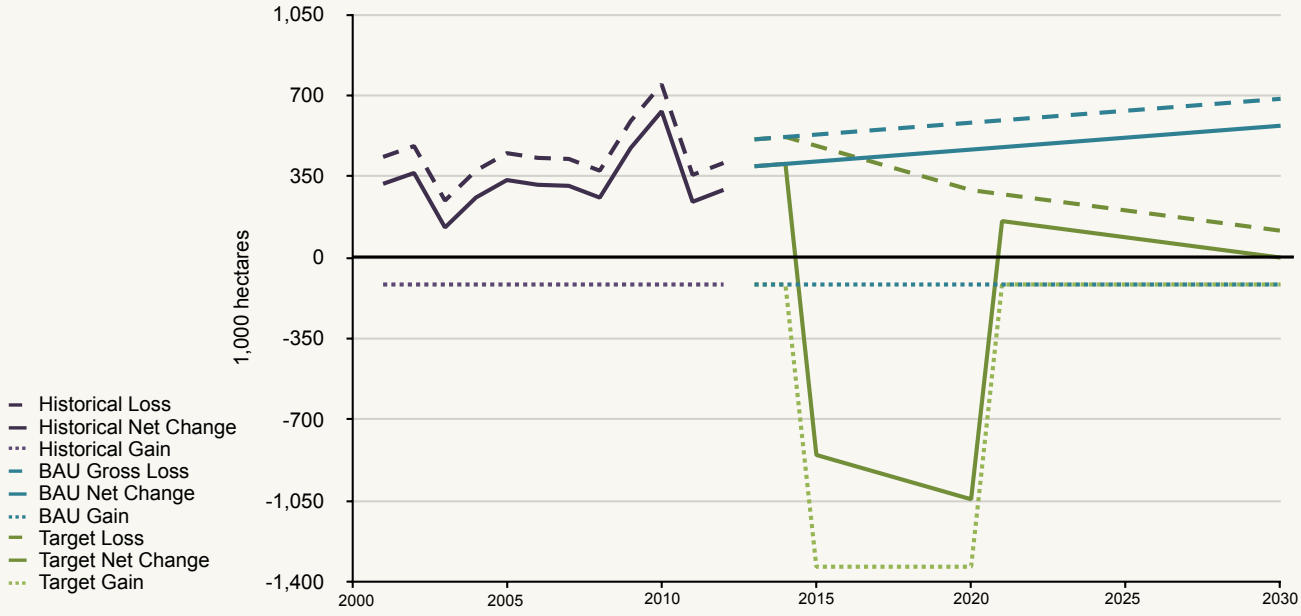
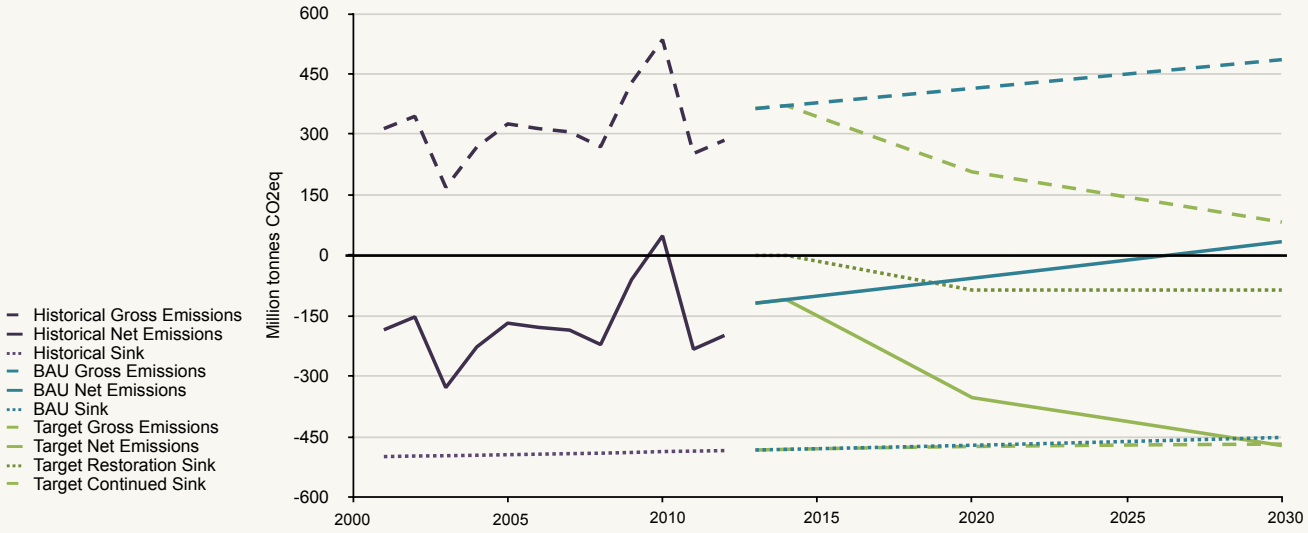


Figure 8. DRC's historical land use emissions and future pathways.



Colombia

Three countries are clustered after Brazil in terms of South America's tropical forest area – Colombia, Peru and Bolivia. We include all three in our sample, but focus particular attention on Colombia given its dominance in the Choco-Darien deforestation front, and Peru given its special role in the UNFCCC process in the lead-up to Paris and the wide array of ambitious forest sector targets it has put forward.

Another HFLD country, Colombia is similar to DRC in its engagement with international processes, having put forward targets in similar contexts (UNFCCC FREL, NYDF, Bonn Challenge). Notably, Colombia has gone farther than many forest countries in its ambition under the UNFCCC – pledging under the Copenhagen Accord to 'reduce deforestation in the Colombian Amazon rainforest to zero by 2020' conditional upon international finance[84]. Colombia's proposed UNFCCC FREL follows on this pledge, being defined for the same scope (deforestation in the Amazon biome, which is 67% of Colombia's forest area). Colombia has also pledged a conditional 1 million hectares of restoration by 2020 (half for agricultural landscapes, using systems such as silvopastoralism, and half in forest landscapes) as part of the Bonn Challenge. It has registered this million hectares in the recent Initiative 20x20.

COLOMBIA HAS PLEDGED TO REDUCE DEFORESTATION IN THE COLOMBIAN AMAZON TO ZERO BY 2020

In our analysis of Colombia's targets, we use data reported in its UNFCCC FREL submission where possible, supplemented by FAO-reported data for national-level forest area loss and gain estimates. Forest loss emissions estimates for the Amazon region in the FREL submission exceed national-level emissions estimates reported to FAO. We base our estimates on the more recent FREL data, scaling the FREL estimates by the proportion of deforestation in the Amazon versus the country as a whole. We also apply a 10% adjustment factor in estimating Colombia's future baseline, as it proposed in its FREL given its low historical deforestation rate[85].

With more than 70% of Colombia's recent annual forest loss (about 116,000 hectares per year)[86] concentrated in the Amazon region, its Amazon zero deforestation target exceeds the NYDF 2020 50% reduction target (assuming deforestation is not expected to rise substantially in other biomes). If Colombia undertakes forest restoration at the scale of its Bonn Challenge pledge beginning in 2015, the rate of restoration (83,000

hectares per year) would cut net forest loss to one third of its baseline rate (128,000 hectares per year). If focused entirely in the Amazon biome, this restoration could exactly counterbalance baseline Amazon deforestation rates – achieving its zero Amazon deforestation pledge on a net basis without reducing gross deforestation below its baseline at all (Figure 9, blue). If gross Amazon deforestation were cut to near zero however, while also pursuing the Bonn restoration, ZND would be achieved by 2017 (Figure 9, green).

The interpretation of targets, and the relationships between them, thus becomes quite critical in drawing overall conclusions. If the Amazon pledge is interpreted on a net basis, and Colombia achieves the pledge through restoring rather than protecting forests, the Copenhagen pledge does not necessarily require any additional action. The NYDF 2020 target of a 50% cut in natural forest loss is less ambiguous, and the 2030 target of zero natural forest loss quite clear. We thus take the NYDF as a sign that Colombia intends its targets to be more aggressive, and use the more aggressive pathways (Figure 9, v2) for summary analyses below.

From an emissions standpoint, whether the Copenhagen target is intended to be net or gross makes a huge the difference (Figure 10). If gross, then Colombia is a net reforesting country by 2017 on an area basis and becomes a net forest carbon sink by 2021 (Figure 10 green). If on the other hand the Copenhagen commitment is intended as net, and is reached largely through Bonn Challenge restoration actions, then in 2020 it would still be a significant net forest carbon source of 56 million tonnes CO2 per year, about the same as the current level (Figure 10 blue) – and it would become a net sink by 2029. The difference between these two scenarios is significant: over 400 million tonnes CO2 total from 2015 to 2030.

Figure 9. Colombia's historical forest area change and targets

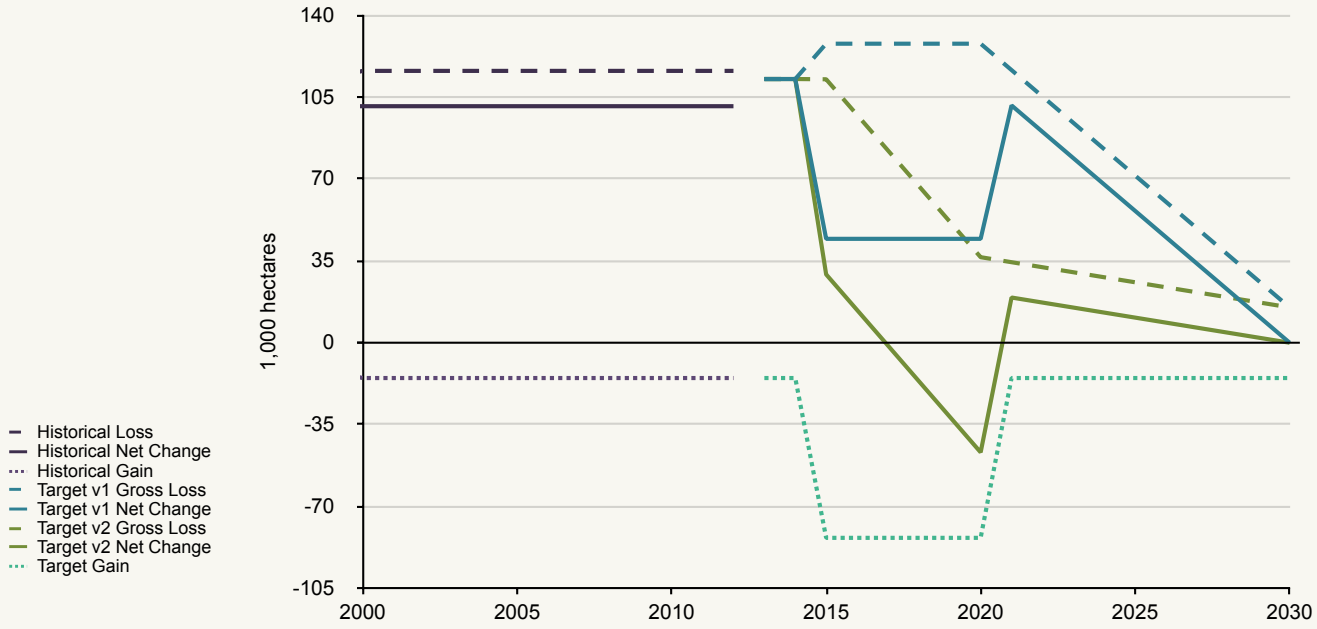
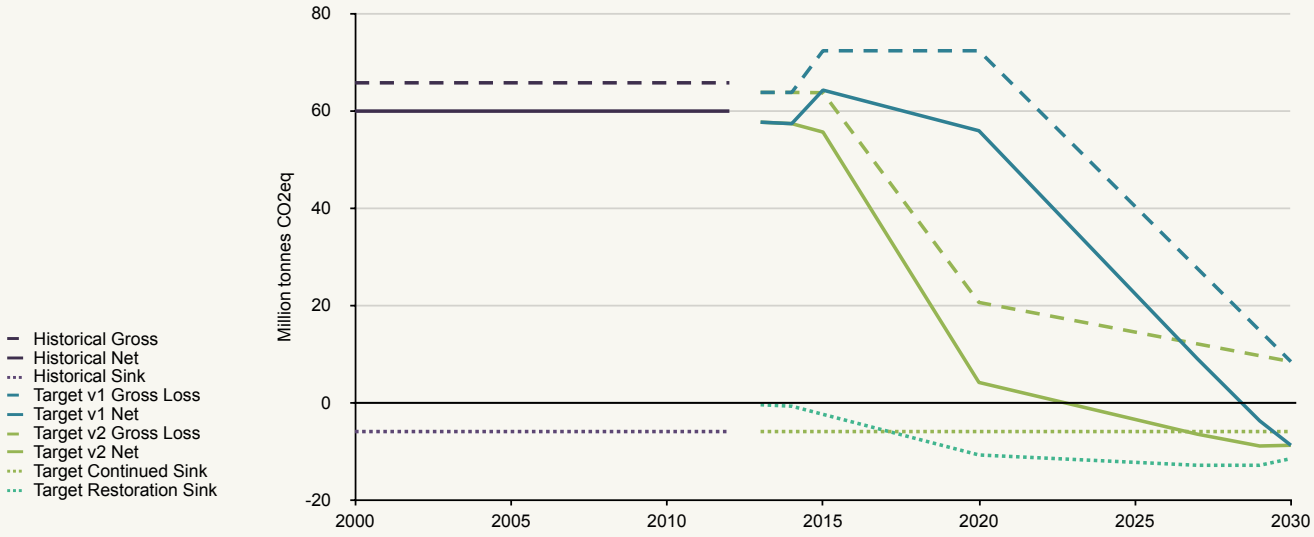


Figure 10. Colombia's historical land use emissions and targets.



Key insights: Colombia

- If fully financed by partner countries and successfully achieved, Colombia's forest sector pledges could surpass ZND on an area basis by 2017.
- The overall forest area and emissions impacts of Colombia's pledges depend on their underlying intent – especially whether restoration and deforestation targets are potentially substitutes rather than additive.

Peru

According to FAO, Peru is fourth in the world in tropical forest area, with a very low rate of forest loss (0.16% per year average from 2001-2012 according to Hansen et al, 0.18% average from 2001-2010 according to FAO). Even with this low rate of deforestation, Peru has put forward an extensive and complex array of goals, targets and commitments to protect and expand its forests (Table 2), including in domestic decrees, the UNFCCC context, voluntary multi-stakeholder processes such as the Bonn Challenge and NYDF, and at the jurisdictional level through the Rio Branco declaration[87,88,89]. These include the goal of zero net deforestation in 54 million hectares of primary forest by 2021 (80% of the country's forest area); a national action plan that develops interim targets for the 54 million hectares of targeted primary forest including 2017 goals of halving the average annual rate of deforestation and LULUCF emissions and reaching zero for both by 2021; an 80% forest loss reduction target for five regions (provinces); and a 3.2 million hectare restoration pledge as part of Initiative 20x20, of which 1 million hectares are targeted for natural forest.

Compared to other countries, estimates of Peru's forest area loss and forest and other land use emissions are relatively consistent across data sets from FAO, Hansen, and the UNFCCC. In its emissions reduction program proposal to the FCPF Carbon Fund, Peru used the Hansen data to estimate its baselines, applying an emissions factor of 116 tC/ha (425 tCO2/ha) and a maximum threshold tree cover percent (75%). We follow these conventions.

About 54.5 million hectares of Peru's 2012 forest area is in the three core regions of the Amazon – Loreto, Madre de Dios, and Ucayali. Amazonas and San Martin, the two additional regions that joined the Rio Branco declaration and 80% by 2020 pledge, contain another 7.1 million hectares. The remaining 11.5 million hectares are in other regions. These three areas experience very different rates of forest cover loss. The 2001-2012 average annual tree cover loss in the Amazon regions was 55,000 hectares per year, or 0.1% of tree cover; in Amazonas and San Martin it is close to 0.5% (33,000 ha/yr); and in other regions it averages 0.3% per year (36,000 ha/yr). In all three areas the recent trend has been upward.

Figure 11. Peru's historical forest area change and targets

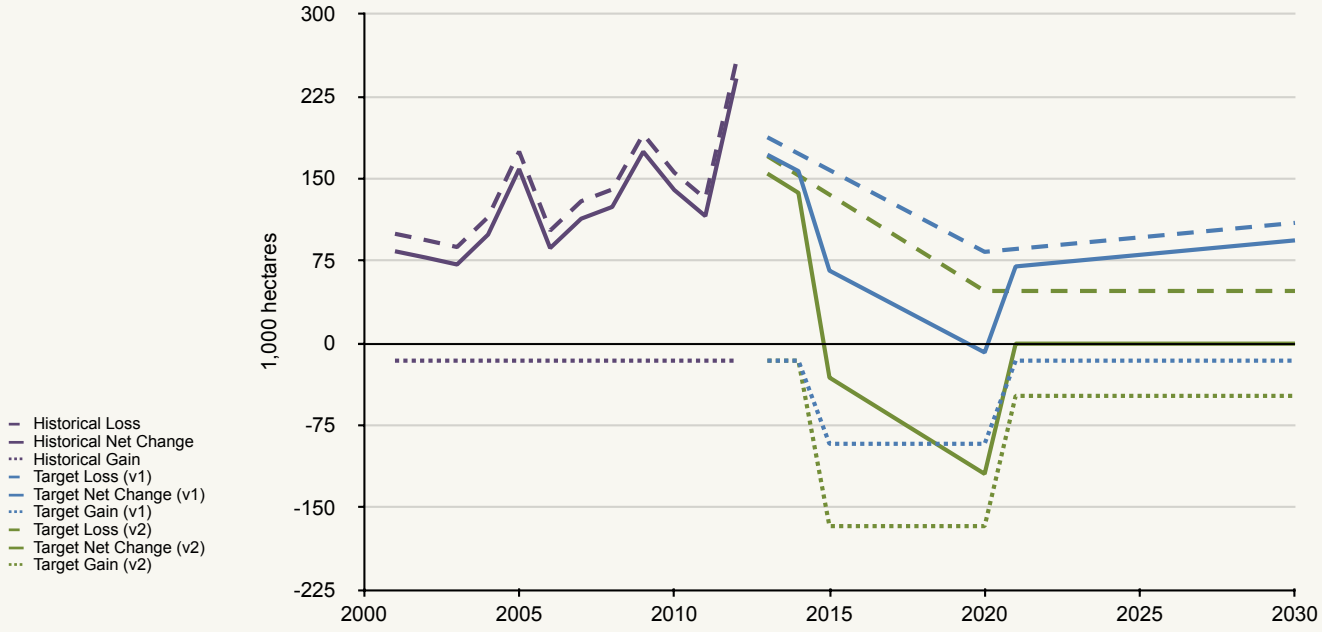
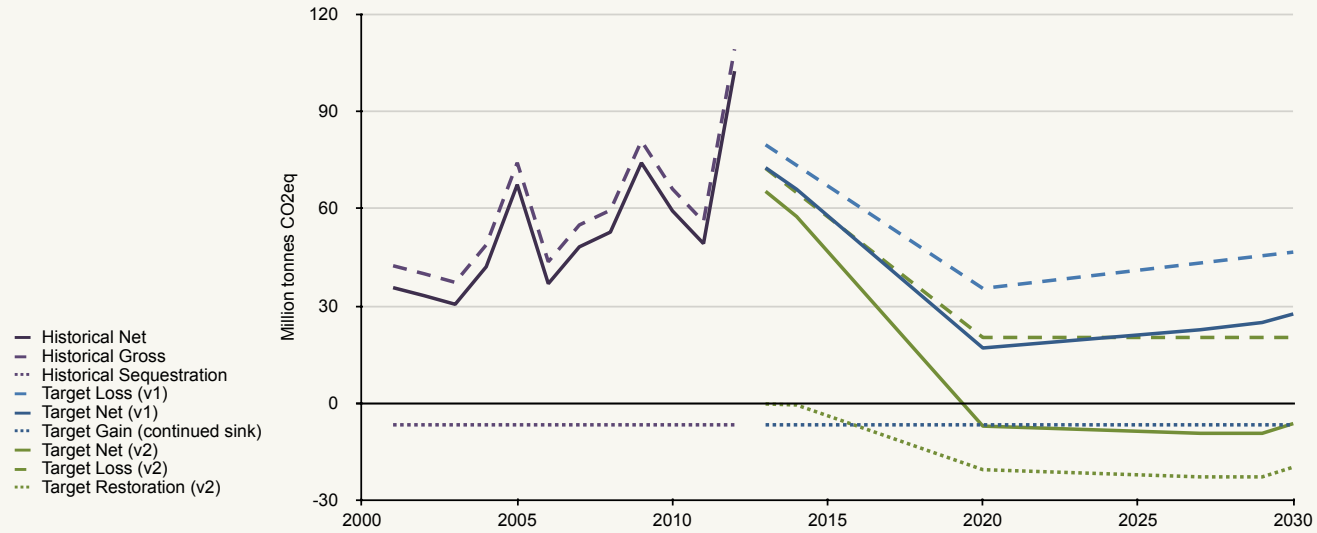


Figure 12. Peru's historical land use emissions and targets



PERU'S TARGETS WOULD ACHIEVE ZND BY 2020. UNDER THE MORE AMBITIOUS SCENARIO PERU'S FORESTS BECOMES A NET CARBON SINK BY 2020

To estimate the impact of Peru's deforestation reduction targets, we apply the zero deforestation 2021 target to the three regions in the Amazon; add in an 80% target for Amazonas and San Martin based on the Rio Branco declaration; and assume a continuation of the trendline outside these regions. As with Colombia, the intent and relationship between different targets creates substantial uncertainty. For example, if Peru's zero deforestation target for the 54 million hectares of primary forest in the Amazon region is intended to be on a net basis, this could be achieved without any cuts to gross forest cover loss by pursuing 450,000 hectares of the million hectare Initiative 20x20 forest restoration pledge in the Amazon region.

Peru's national targets would also be clearer if the country were to signal what forest loss rates they are aiming for in regions outside the primary target areas. For example, there is a 35,000 hectare (and 15 million tonnes CO2) difference between a 2020 target based on the 2001 to 2012 average in non-Rio Branco regions, based on a target that continues on the current upward trend in these regions.

We thus model two pathways for Peru. One is a higher emissions, higher forest loss pathway with a portion of the restoration pledge substituting for deforestation reduction in the Amazon, and with forest loss rates continuing on their recent upward trend for all regions that don't have explicit targets. The second is a lower emissions, lower loss pathway in which all restoration is additional and deforestation rates outside the Rio Branco regions are stable at the 2001-2012 average.

Both scenarios achieve ZND by 2020 (Figure 11, blue and green). In the more ambitious scenario Peru becomes a net forest sink by 2020 (Figure 12, green). Looking ahead to 2030, Peru would maintain a 'close to zero' gross national forest loss rate of around 0.13% even if states without existing pledges continued on their current upward trajectory of deforestation.

However, such a trend would not maintain ZND through to 2030: meeting that target would require some combination of continued restoration action beyond 2020 and/or lower than business as usual gross forest loss in the non-Amazon region. Given Peru's signing of the NYDF, we set its 2030 target to achieve ZND in 2030 using the approach of continued restoration to the order of 48,000 hectares per year nationally.

Other South American forest countries

Bolivia

The most recent internationally reported forest area statistics we could find from the government of Bolivia were in its CBD 4th National Communication, with rates of loss averaging about 246,000 hectares per year from 1990 to 2010 (relatively consistent with the FAOStat average of 284,000)[90].

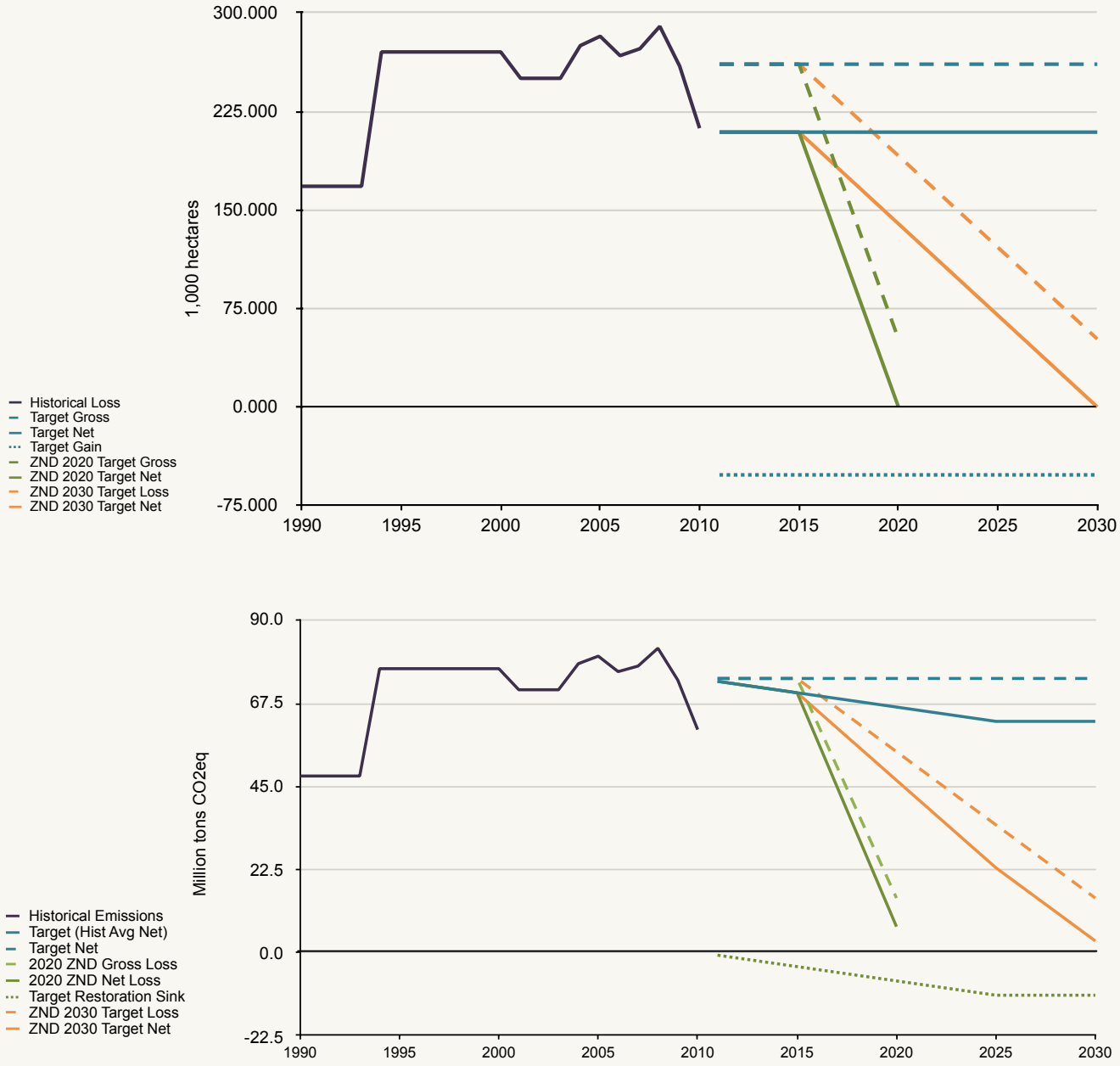
We were able to identify one quantitative forest sector objective from Bolivia's National Forest and Climate Change Strategy of 2009, of 'increasing the country's forest coverage to 10% of degraded and deforested area in the next 10 years.[91]' The baseline for this target is not clear; 10% of total restoration potential (106 million hectares[92]) would suggest a target restoration rate of about 50 times recent deforestation rates, which seems unlikely.

We interpret it instead as 10% of the total deforestation area reported from 1990-2010 (5.2 million hectares), suggesting a restoration area target of 52,000 hectares per year from 2011 to 2020, which is about one fifth of the current rate of forest loss.

Assuming stable deforestation rates in Bolivia at the government-reported historical average, along with this level of forest restoration, Bolivia's 2020 target deforestation rate is in the range of 194,000 hectares per year producing emissions of about 66.6 million tonnes CO2 per year after accounting for sequestration from restoration.

Reaching ZND in either 2020 or 2030 with this level of restoration would require an 80% cut in gross forest loss rates from about 0.46% per year down to below 0.1% per year.

Figure 13. Bolivia's historical forest area (above) and land use emissions (below).

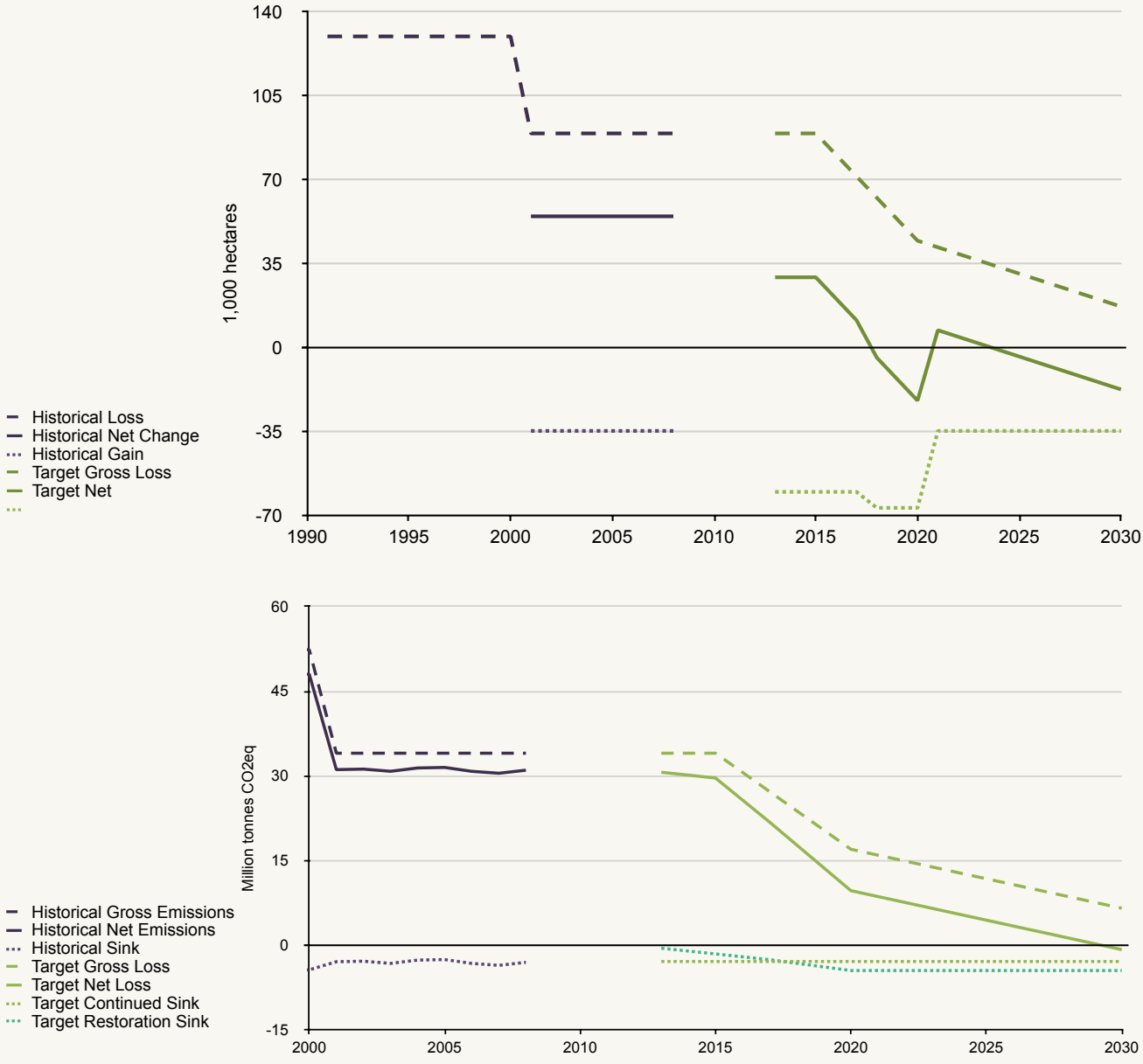


Ecuador

The FREL submitted by Ecuador to the UNFCCC in 2014 estimates recent gross forest area loss as averaging about 90,000 ha per year from 2000-2008, a significant decrease from the previous decade's average of 130,000 ha per year[93]. These estimates are closer to the Hansen estimates – especially on a net basis – than to the FAO estimates[94]. Ecuador's FREL submission also suggests a forest recovery rate of 35,000 hectares per year over the period, for a net forest area loss of 55,000 hectares per year.

We identified two restoration targets from the government of Ecuador: a 300,000 hectare total restoration goal identified in the 2013-2017 'Good Living' National Plan (PNBV by its Spanish acronym); and a 200,000 hectare pledge in 2014's Initiative

Figure 14. Ecuador's historical and target forest area (above) and land use emissions (below).



20x20. The 20x20 pledge is additional to the previous goal – and we treat it as increasing the restoration target from 60,000 hectares per year for 2013 to 2017 to 67,000 hectares per year for 2018 to 2020 to achieve 500,000 hectares in total.

We assume that both pledges are intended as total restoration targets, rather than as additional restoration on top of the historical forest recovery rate; and that both are conditional upon finance. Ecuador signed the NYDF, and so we assume that it would halve gross forest loss by 2020 and seek near zero natural forest loss by 2030. To reach 0.2% per year would require cutting forest loss to around 17,000 hectares per year, more than offset by Ecuador's historical rate of forest recovery, if such recovery were of natural forests.

Given these assumptions, we estimate that Ecuador's restoration targets alone would get about 75% of the way from the baseline to ZND in 2020, and the NYDF target of halving of forest loss would push Ecuador to below ZND-2020 by as much as 23,000 hectares. Even if significant additional restoration action did not continue past 2020, Ecuador's NYDF 2030 target would keep it a net reforester through most of the decade. Ecuador's emissions target reflects the power of simultaneously reducing forest loss and increasing restoration – its net emissions are cut by 70% in 2020, and Ecuador becomes a net sink in 2029.

Argentina

The far northeastern corner of Argentina (the province of Misiones) stretches into the Atlantic Forest biome, one of the most threated forests on Earth. This presence in one of the deforestation fronts means that Argentina is included in our sample. But we were not able to identify forest loss or restoration targets or goals specific to these forests.

ONLY ONE TARGET WAS IDENTIFIED RELEVANT TO ARGENTINA. IT IS A GOAL BY A PRIVATE FOUNDATION TO RESTORE 4.1 MILLLION HECTARES IN THE PATAGONIA REGION

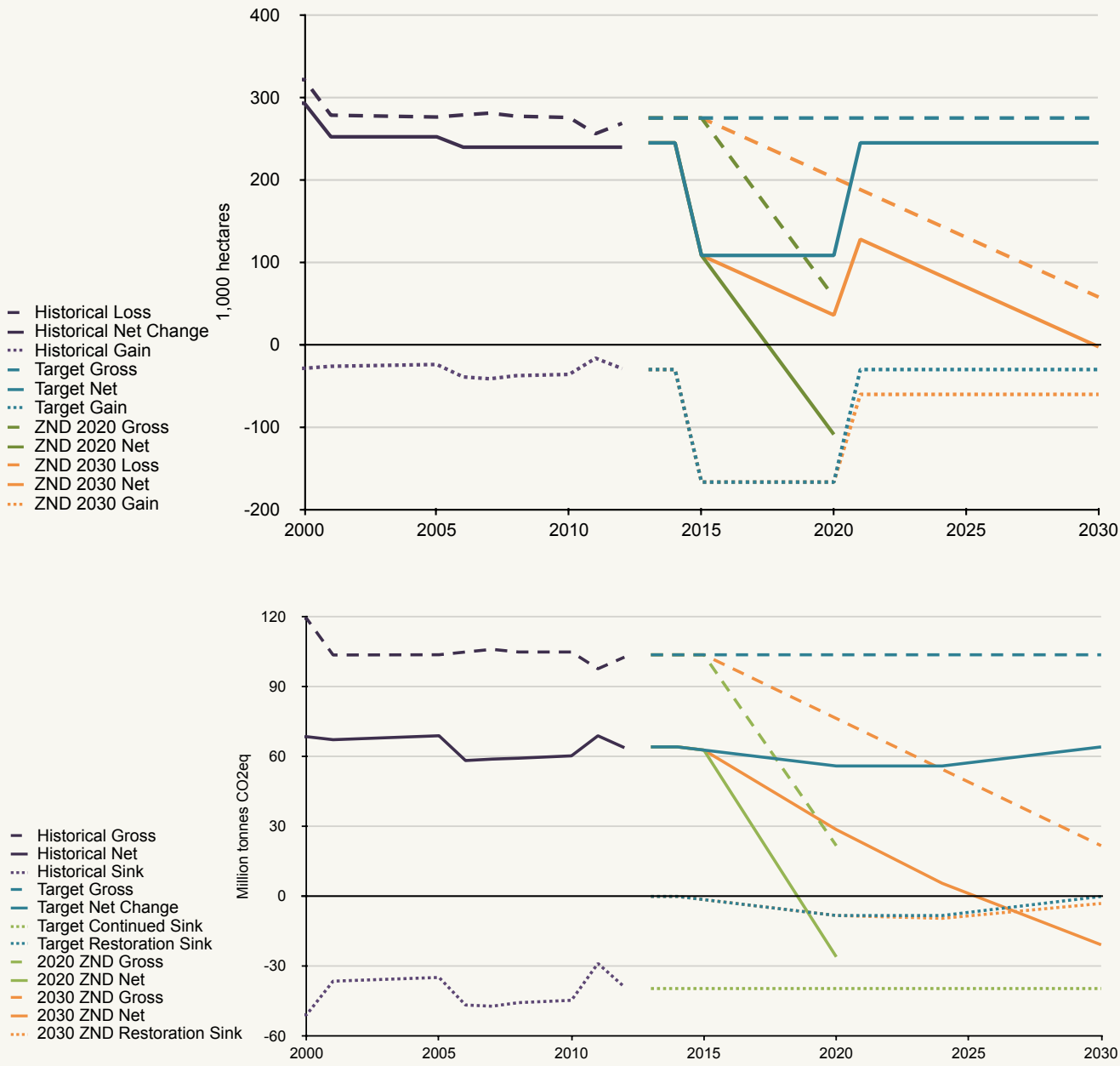
The only target we were able to identify relevant to Argentina's forest sector was the Initiative 20x20 pledge made in December 2014 by the private foundation Conservación Patagónica to restore 4.1 million hectares in the Patagonia region across Chile and Argentina. We assume that 20% of this commitment (820,000 hectares) is targeted for Argentina, corresponding to the proportion of area conserved in Argentina by the organisation in the past (pers. com.).

At 137,000 hectares of restoration per year, this target would cut Argentina's 2001-2012 average net forest area loss of 245,000 hectares (FAO) by more than half, to about 108,000 hectares of net forest loss per year in 2020. Assuming a somewhat generous sequestration of 10 tonnes CO_2 per hectare per year from restoration actions up to 100 tonnes (just over the national average density for 30% forest cover in Saatchi et al), this level of forest restoration would create a carbon sink of about 8 million tonnes CO_2 per year by 2020, reducing Argentina's net forest emissions by about an eighth from the current 64 million tonnes CO_2 per year.

Argentina would need to cut its recent 1% per year rate of gross forest area loss by about 40% to equal the rate of restoration pledged, which would achieve ZND from a technical standpoint. However, losing 165,000 hectares of natural forest per year – 0.6% of Argentina's total forest area – doesn't meet the test of 'near zero natural forest loss.'

Argentina would need to reduce forest loss substantially further to get near zero: we model 60,000 hectares per year, or 0.2%, for the ZND-2020 and -2030 scenarios, balanced by continued restoration after 2020 at a similar scale. At historical rates of sequestration of close to 40 million tonnes CO_2 per year, a reduction in forest loss this large would flip Argentina's forests from a net emissions source to a net sink.

Figure 15. Argentina's historical and target forest area (above) and land use emissions (below).



Paraguay

PARAGUAY HAS A LAW PLACING A LAND CONVERSION MORATORIUM ON THE ENTIRE EASTERN HALF OF THE COUNTRY

After Brazil, Paraguay is home to the second-largest extent of Atlantic forest. The government of Paraguay has taken dramatic action to stem forest loss in the region – passing in 2004 a land conversion moratorium for the entire eastern half of the country (the Oriental region), in which the Atlantic forests are found[95]. The law, extended several times and now effective until 2018, is the only clear deforestation reduction commitment we were able to identify for Paraguay. It has been credited with helping achieve a significant decline in deforestation in the region[96].

Various sources of self-reported data on forest loss and emissions from Paraguay (FAO FRA, FAOStat, UNFCCC) lack year-to-year variability as well as the regional detail necessary to analyse Paraguay's Atlantic Forest pledge[97], so we instead look to Hansen data for this analysis[98].

There was a drop in tree cover loss in the Oriental region after 2004 when the rate of loss peaked at over 2% per year, to 0.5% per year in 2009. However, the rate rose thereafter until 2012 when it reached 1.4%. Tree cover loss in the northwest (Occidental) region has increased substantially since 2004, driving the national rate up. Paraguay thus has a very long way to go to reaching ZND, even with a strong zero-deforestation law protecting critical habitat in the Atlantic Forest.
If deforestation in the northwest continues along its post-2004 upward trend line, then forest loss would be 600,000 hectares per year in 2020, up 50% from the 2000-2012 national average and hitting a rate of 3.4% per year. If Paraguay levels off deforestation in the Occidental region at the recent historical average, it would still be losing close to 1.2% of its forest area annually.

To reach ZND would require ambitious action to slow loss in the Occidental region, and a significant national commitment to restoration. For example, Paraguay would reach ZND if it were to cut forest loss in the Occidental region by about 65% while also achieving 80,000 hectares per year of forest restoration – preferably by restoring habitat in the Atlantic Forest region.

Figure 16. Paraguay's historical forest area change and targets.

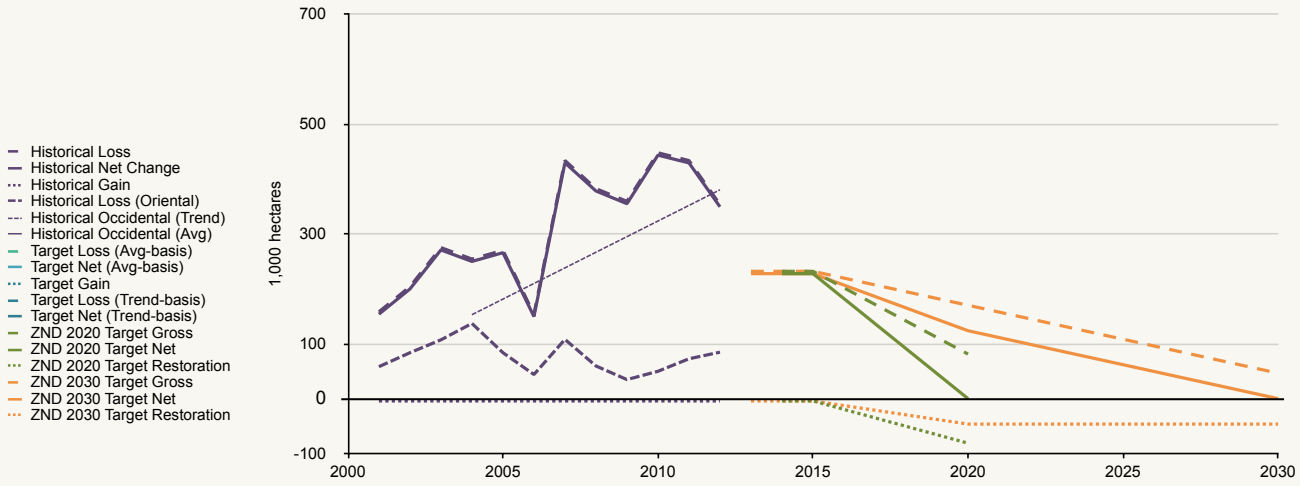
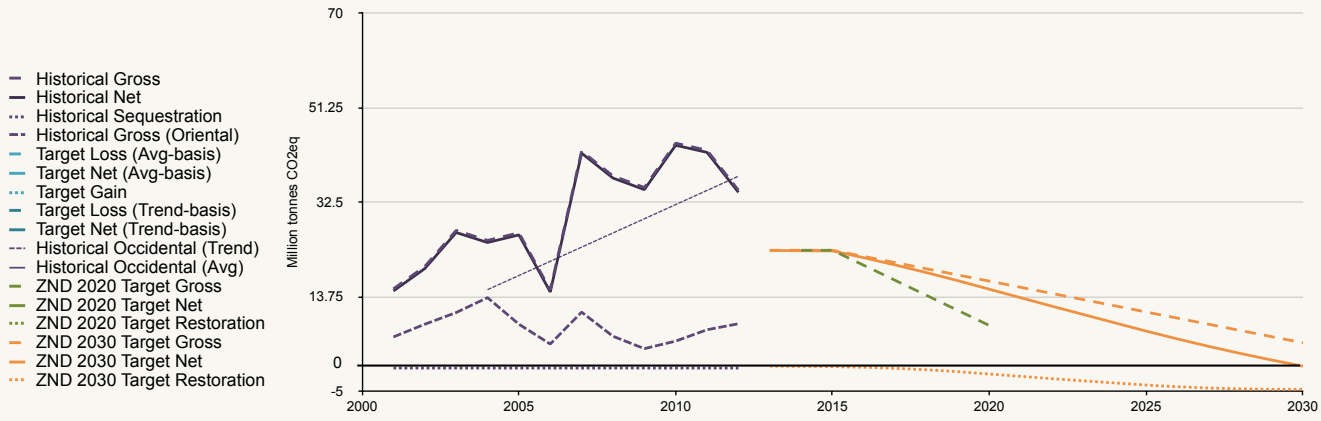


Figure 17. Paraguay's historical forest emissions and targets.



Other African forest countries

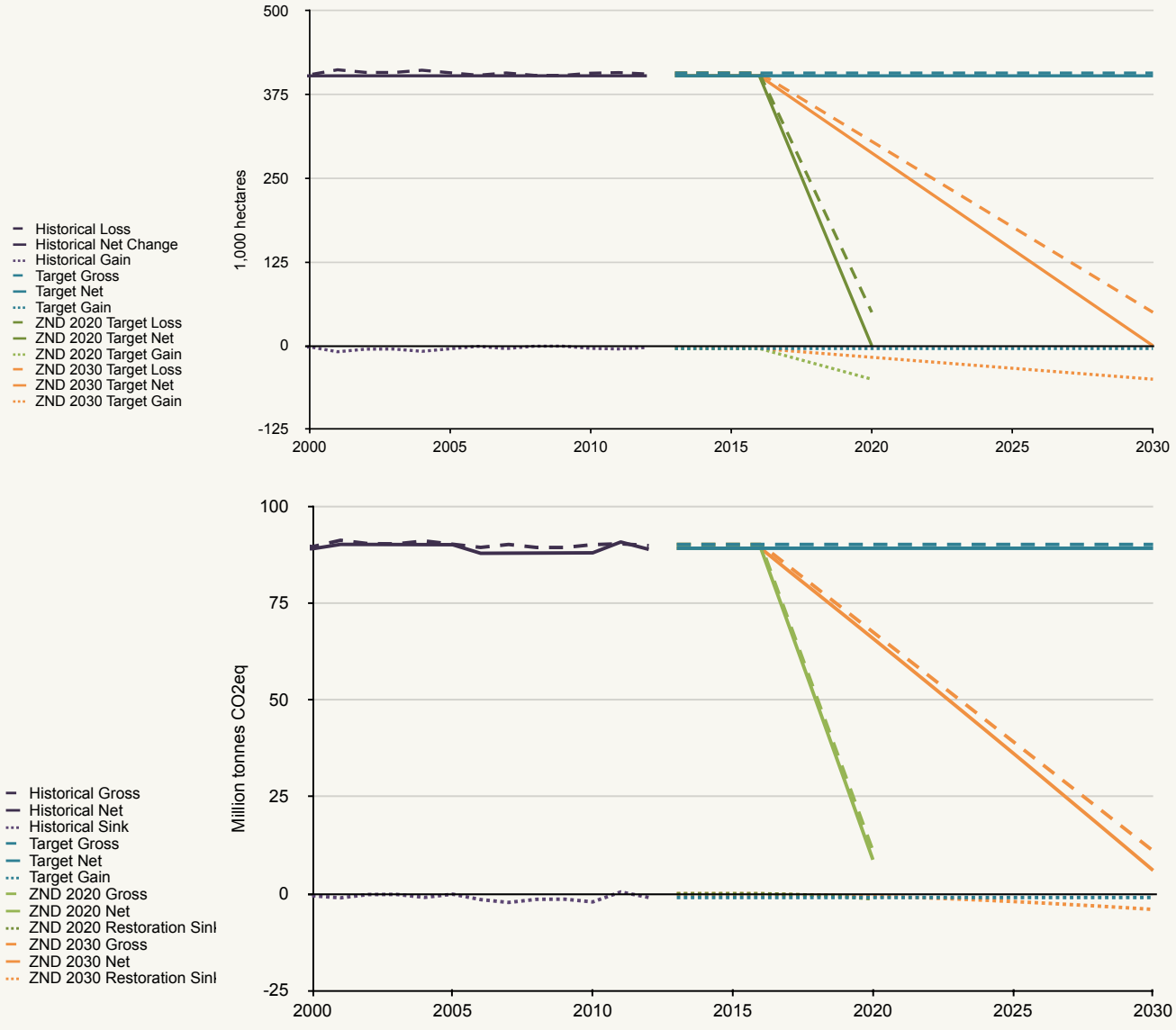
Tanzania

NEITHER TANZANIA OR MOZAMBIQUE CURRENTLY HAVE OFFICIAL TARGETS TO REDUCE FOREST LOSS

Forests are a critical resource for most Tanzanians, with 95% of the country's energy supply met by fuelwood[99]. They are also being lost quickly – national data reported to FAO suggest a loss per year of 1.17% between 2000 and 2005, which is the fifth fastest rate in the world (according to this source). The rate of loss according to Hansen et al (2013) is lower. At a 25% cover threshold, which generates a similar estimate of forest extent, forest cover is being lost at about 0.3% per year – a significant discrepancy.

Tanzania's draft REDD+ strategy suggests it will use satellite data sources (a modified version of the FRA RSS methodology) to estimate its reference level. However, until such data are available we use the FRA data that the government cites. At this rapid rate of forest loss, it would take significant action to slow the loss to ZND by 2020 or 2030 – for example by cutting gross deforestation by 88% to reach about 0.15% per year, while at the same time restoring 50,000 hectares per year[100].

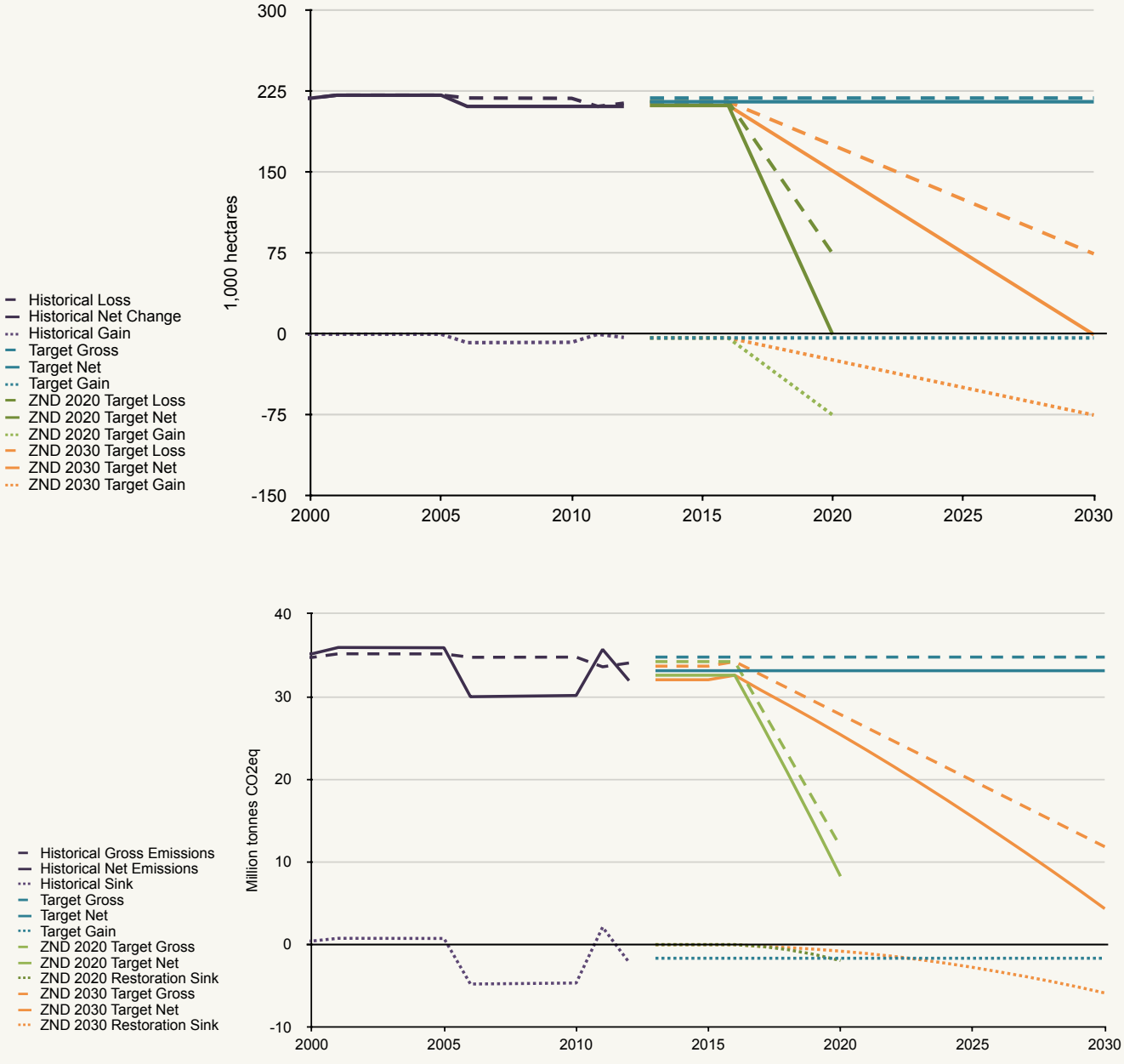
Figure 18. Tanzania's historical and target forest area (above) and emissions (below).



Mozambique

With close to 2% of the world's tropical forests, including a large swath of the threatened Eastern Miombo woodlands, Mozambique's continued loss of over 200,000 hectares per year (0.5% per year) is globally significant. Mozambique is participating in both the FCPF readiness process and UN-REDD, and has put forward a clear timeline for data collection and defining a FREL. However, we were not able to identify any existing targets for deforestation reduction or restoration in Mozambique, nor recent forest loss and emissions statistics beyond those reported to FAO[101]. Regardless, there is significant potential for both deforestation reduction and restoration in Mozambique. Potapov et al (2011) identify 57 million hectares with restoration potential. If Mozambique were to target a 65% cut in gross deforestation from recent historical rates (down to 0.2% per year), and achieved 75,000 hectares of restoration per year, it could reach ZND albeit with some natural forest loss.

Figure 19. Mozambique's historical and target forest area and emissions.

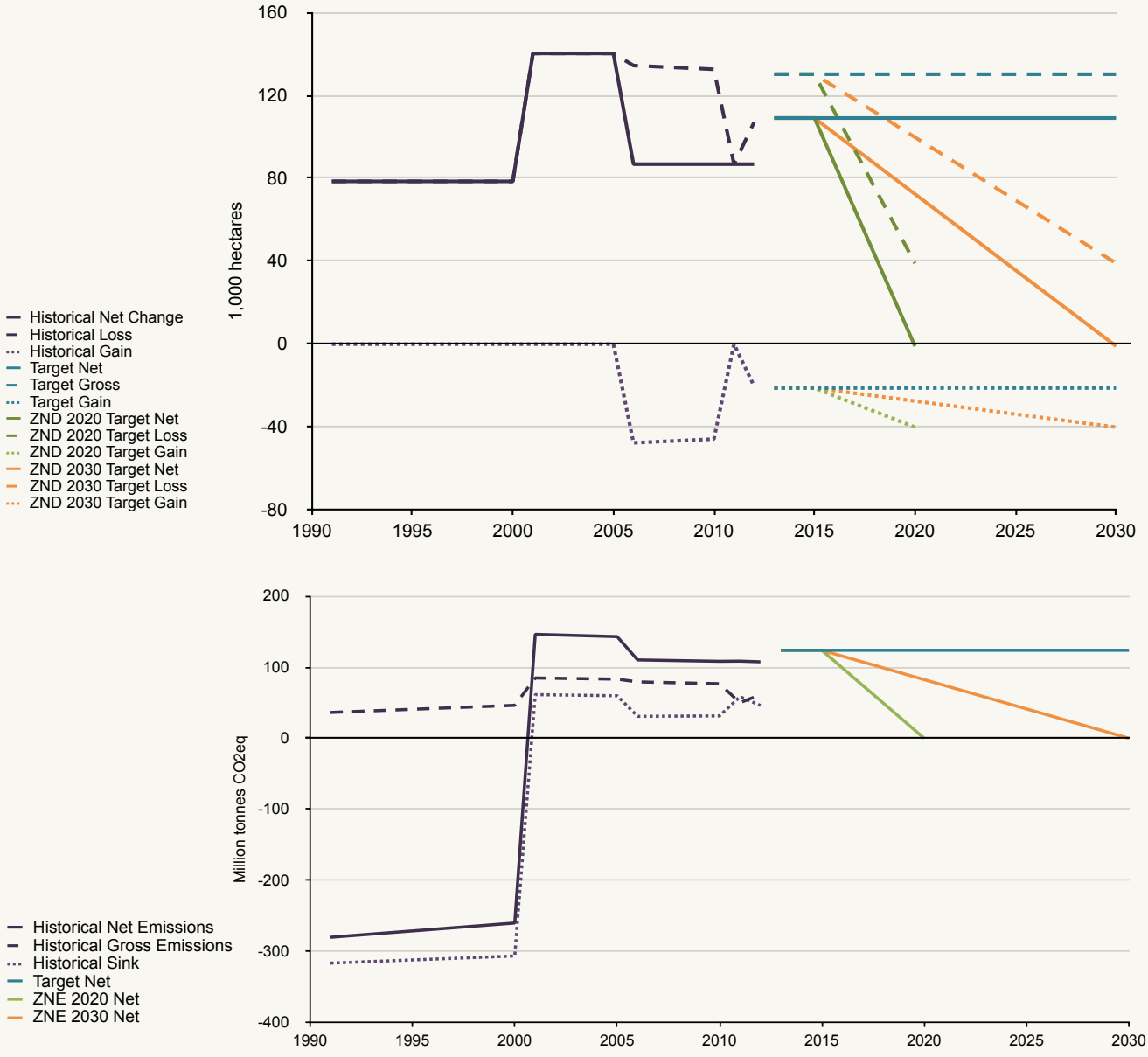


Other Asia and Pacific countries

Malaysia

Malaysia has pledged to maintain at least 50% of its land area in forest (16.4 million hectares). It has put forward a UNFCCC FREL covering the sustainable management of forests within Malaysia's legally-defined permanent reserve forest. Most of this 12.7 million or so hectare area (38.4% of land area) is naturally regenerating forest actively managed for timber and fibre production. Malaysia reports 1.8 million hectares of planted forest to FAO, which together with the permanent reserve forest appear to make up the 14.3 million hectares of Malaysia's reported 'permanent forest estate.' Malaysia reports 4.6 million hectares of forest in protected areas. Together, the permanent reserve forest area and protected forest area total 52.5% of Malaysia's land area.

Figure 20. Malaysia's historical and target forest area (above) and emissions (below).



All other areas are identified as the 'land bank for development.'[102] In fact, much of this area has tree cover: Hansen (2013) estimates that 24.7 million hectares have 30% or greater tree cover. This estimate would exclude any recently harvested areas, so in fact it's likely that the total area either legally defined as forest or with substantial tree cover is greater. Much of this area is plantations: 1.8 million hectares or so of timber plantations; another 5 million hectares or so of palm oil plantations[103]; and upwards of 2 million hectares of rubber plantations.

Malaysia's FREL submission provides detailed official statistics of recent emissions trends from the permanent reserve forest[104]. Carbon uptake has been relatively constant, while removals from harvest have declined by more than half – so this forest appears to be a significant (232 million tonnes CO2 per year) and apparently increasing (at 3.6 million tonnes per year) carbon sink. However, while the size of the permanent forest reserve has been relatively constant for 20 years (fluctuating between 12.3 and 13 million hectares with no clear trend), total forest area as reported to FAO has been declining at a rate of about 130,000 hectares per year (0.64% annual loss).

With 18.65 million hectares of primary and other naturally regenerating forests reported in 2010 to FAO, Malaysia could continue this rate of loss until 2030 and still meet its 50% forest cover target. In fact the target could be met even if deforestation accelerates, at least for a time. Cutting this level of gross deforestation and exceeding the 50% forest cover target could eliminate 77 million tonnes of CO2 emissions per year – significantly more than the total CO2 removed in all harvesting in permanent reserve forests according to the FREL.

A ZND pathway for Malaysia could be achieved through a 70% cut in gross forest loss along with restoration of 20,000 hectares per year. It is difficult to estimate the potential emissions impact of such a change, however, as the historical emissions data are inconsistent across sources: LULUCF is a substantial net sink in Malaysia's UNFCCC reporting; and flips from a strong sink to a strong source in 2001 in FAOStat. So, for Malaysia's emissions, we thus model net emissions independent of the potential area pledge – using the last decade average reported to FAO as a baseline, and potential reduction pathways reaching net zero in 2020 or 2030.

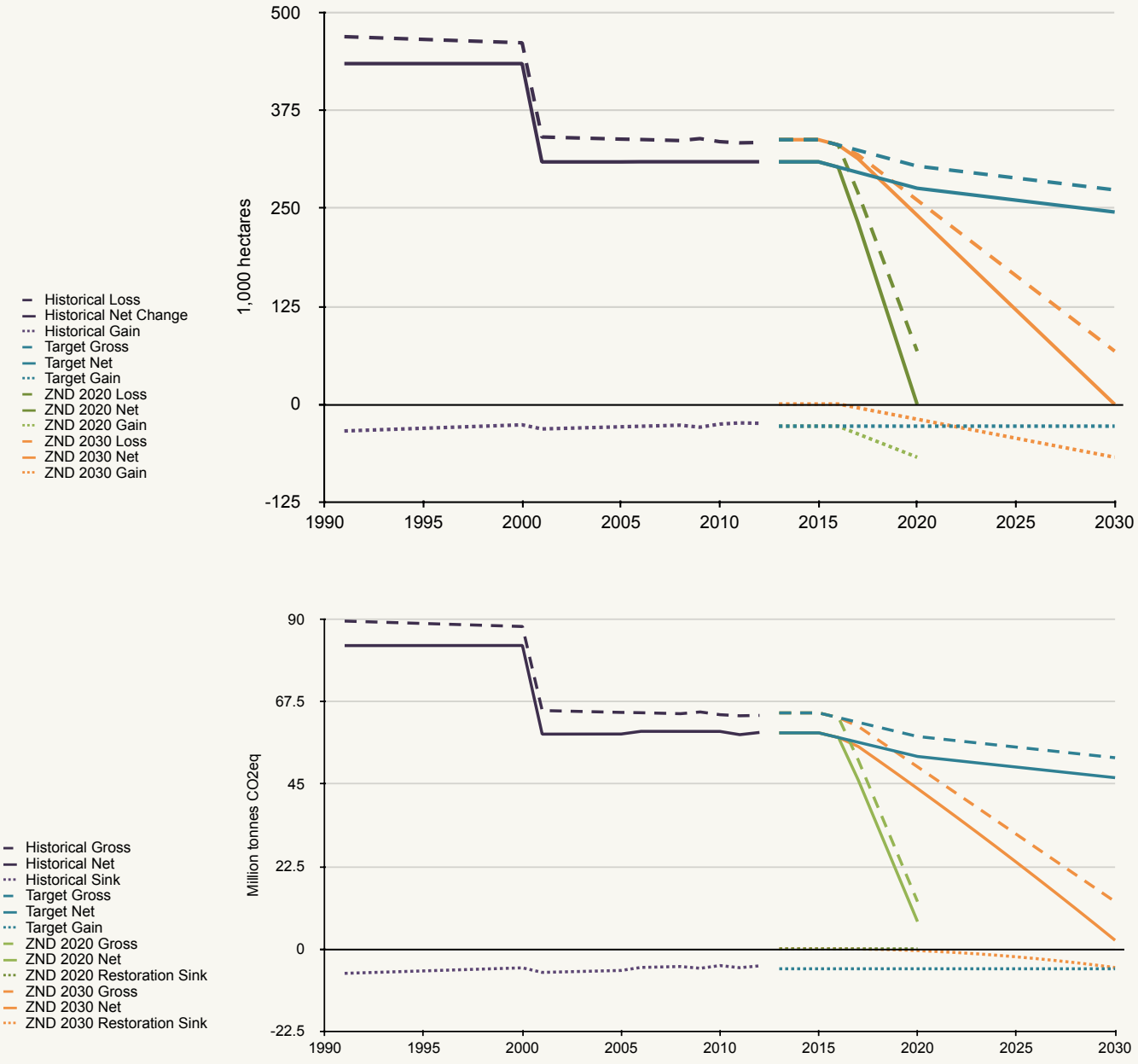
Myanmar

While close to half of Myanmar is forested, only 10% of its forest area is primary forest (FAO FRA). Natural forest area has been falling at a rapid rate of about 1% loss per year (about 310,000 hectares per year) as forest plantations have expanded from 400,000 hectares in 1990 to a million hectares total in 2010 (FAO FRA)[105]. We identified one relevant target highlighted by Myanmar in a recent sustainable development plan to double protected area to 10% of land area over the first 30 years of the millennium[106]. The IUCN World Database of Protected Areas[107] estimates that 4.827 million hectares out of Myanmar's 67.3 million hectares of land area are protected, or just over 7%. To reach 10% would require protecting another 1.9 million hectares by 2030, or about 120,000 hectares per year starting in 2015.

While protected areas are an important element of a deforestation reduction strategy, it is difficult to quantitatively estimate the impact of such protected areas without specific geographic targets. If they are located in areas with very high rates of deforestation (for example 5% per year), 720,000 hectares of effective new protected areas by 2020 could conceivably prevent 36,000 hectares of forest loss – about 10% of recent historical annual gross forest loss.

With this very rough approach to Myanmar's existing forest loss target, we estimate a slight cut in deforestation down to 276,000 hectares per year net in 2020. A very aggressive target would be necessary to reach ZND by 2020 or 2030 – for example cutting gross forest loss by 80% from the recent average while restoring 40,000 hectares per year of native forest habitat.

Figure 21. Myanmar's historical and target forest area (above) and emissions (below).

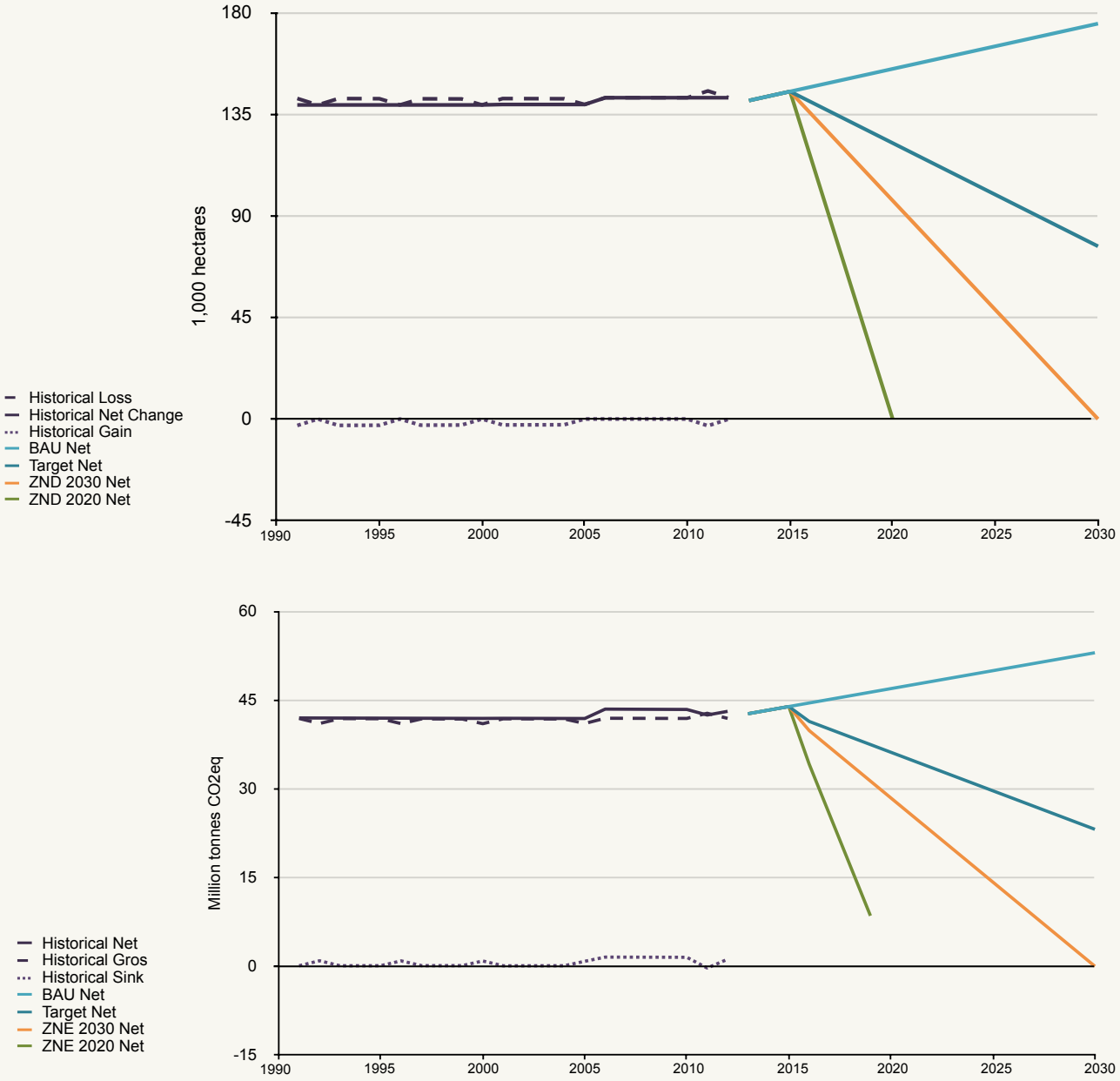


Papua New Guinea

Papua New Guinea (PNG) was one of the earliest proponents of REDD+, and a co-founder of the Coalition of Rainforest Nations. It is home to some of the largest intact tropical forest landscapes in Southeast Asia (91% of its forest area is primary forest), which are being cleared at a rate of about 0.5% per year (140,000 hectares per year).

Most forest loss in PNG of the last decade has been the result of unsustainable rates of timber extraction, with shifting cultivation the second major cause. LULUCF is the source of 90% or more of PNG's climate emissions.

Figure 22. PNG's historical and target forest area (above) and emissions (below).



In Copenhagen, PNG pledged to cut emissions in half by 2030 against business as usual, and to be carbon neutral by 2050, conditional not just on finance but also on reaching what it considered a sufficient climate agreement. PNG published sophisticated analysis by McKinsey of its business as usual pathways and emissions reduction potentials through 2030 following the Copenhagen agreement, including assessment of potential opportunity costs of different pathways; the analysis did not, however, include historical data from the forest sector[108].

There is significant uncertainty and variance in historical land use area change and emissions between different data sources for PNG[109]. Because little forest area gain or forest sequestration is reported to FAO, we model only net deforestation and net emissions for the country using FAO data for the historical baseline. We calculate rates of change in forest sector emissions until 2030 for McKinsey's modelled business as usual pathway and 50% by 2030 reduction pathway; these rates of change are applied to recent historical net forest area loss and emissions to calculate forest area and forest emissions pathways for BAU and the 50% target.

This target pathway would result in forest area loss of about 122,000 hectares in 2020, a 13% cut below recent historical levels and 21% cut from business as usual; and 76,000 hectares in 2030, a 46% cut from recent historical levels and 56% cut from business as usual.

Temperate and boreal forests

BEYOND THE TROPICS, LARGE SWATHES OF TEMPERATE AND BOREAL FORESTS ARE FOUND IN AUSTRALIA, CANADA, CHINA, RUSSIA AND THE US

This report has focused on 10 out of the 11 'deforestation fronts' identified by WWF. This reflects the focus on informing REDD+ agreements and places where international partnerships will be needed most to achieve change. This section reflects briefly on policy developments in the other five major forest nations that are home to large swathes of temperate and boreal forests: Australia (where the 11th deforestation front is found), Canada, China, Russia, and the US.

Australia – Land clearing was rampant in the forests and woodlands of eastern Australia, until the enactment of new laws in the states of New South Wales and Queensland in 2005. Notable in particular is Australia's Native Vegetation Framework endorsed in 2012 and its first goal to 'increase the national extent and connectivity of native vegetation' by 2020 – on the face of it in line with ZND by 2020[110]. But there are now plans to weaken key legislation in these two states.

In Queensland, a 2006 ban on large-scale clearing of primary forests was partly removed in 2013 and there has been a resurgence of clearing, both legal and newly legalised[111]. Similarly, in New South Wales there is a legislative proposal to repeal existing deforestation laws and replace them with weaker substitutes[112]. In policy terms, therefore, the forests in eastern Australia are at risk of being in net decline by 2020. Projections of land clearing across the entire eastern Australia 'deforestation front' range between 3 to 6 million ha of all forests lost from 2010 to 2030[113].

Canada – Canada's 2014 national communication to the UNFCCC[114] projected that the LULUCF sector (dominated by managed forest lands) in Canada will be a net sink of GHG emissions in 2020 of 28 MtCO2e. This compares to 2011, when the net emissions of the sector were 87 MtCO2e. This could be interpreted as a net positive forest cover scenario, though there is no such national policy statement and the policy interventions to shift the practices of the sector leading to this net positive emissions outcome are largely sub national. This figure also does not account for natural disturbances other than a background rate of forest fires. So annual emissions – and forest cover – may well fluctuate significantly due to natural causes.

China – In 2009, the Chinese government set a target of increasing forest area by 40 million hectares against a 2005 baseline by 2020. China announced in 2014 that its forest cover had increased to 21.63% from 20.36% in 2010 in just three years and it was on course for the 2020 target[115]. This may contradict with the data used by Global Forest Watch, which found China to have the seventh highest average annual rate of tree cover loss between 2011-2013: 523,000 hectares.

It's likely that at least part of this discrepancy is due to the ongoing large scale planting of tree cover in China, in particular through the Conversion of Cropland to Forest Programme, which may not have yet been captured by the Global Forest Watch data (for reasons explained above). So China's net forest cover growth could be attributed to the expansion of planted forests. If this occurs while a large amount of natural forest is still lost, this would not achieve ZND by WWF's definition.

However, in 2015 through the Natural Forest Conservation Programme China has also taken action to reduce natural forest loss: all logging and clearing for grazing was banned in the natural forests of northeast China and will be banned nationwide by 2017. By some measures, China is already a net reforesting country; and based on these policies, China has set the ambition to maintain this status.

Russia – National policy stipulates that forest cover should be preserved at 46% of the total country's area. This constitutes a cap on deforestation, and potentially a zero net deforestation target of sorts. Nevertheless, forests are at risk. WWF analysis found that 21 million ha of forest cover was lost in Russia between 2000 and 2013. It also found that most of this was due to fragmentation caused by forest fires (60%), logging (23%) and mining (17%)[116]. As a result, WWF is advocating for an end to logging in intact forest landscapes, and instead the intensive management of secondary forests.

United States of America – The United States has both temperate and boreal forests, and according to the US Forest Service its forest land base has remained relatively stable for almost 100 years despite population growth. This is expected to change, and the US Forest Service projects that population growth (and associated land developments) will mean 6.5-14 million hectares of forest land loses by 2060[117].

POLICIES IN CANADA, CHINA AND THE US TARGET NET GROWTH IN FOREST COVER AND THEIR FORESTS BEING NET SINKS OF EMISSIONS

In the nearer term, however, federal policy statements indicate intent to use forests in its climate policy. National communication to the UNFCCC (2014)[118] stated that LULUCF activities in 2011 resulted in a net carbon sequestration of 905 Tg CO2e. Forests (including vegetation, soils, and harvested wood) accounted for 92% of that total flux. This net gain was attributed to net forest growth, increased forest area, and a net accumulation of carbon stocks in harvested wood pools.

The communication also highlights intent to identify 'new approaches to protect and restore our forests, as well as other critical landscapes'. The US Forest Service leads a pledge under the Bonn Challenge to restore 15 million ha of land using an 'all lands approach'. These policy statements set ambition at maintaining a net positive forest cover change up to 2020 and likely beyond.

SUMMARY OF NATIONAL AND REGIONAL PROGRESS TO ZND

Regional findings in brief:

- Based on the national pledges and commitments analysed, Latin America comes the closest to targeting ZND in 2020, halfway there (50%). Asia is 21% of the way there, while Africa appears to go further (38%) if you allow large-scale restoration targets in DRC to offset forest loss in other countries, but only gets 12% of the way if not.
- Unsurprisingly, Brazil, Indonesia and DRC dominate the results of this analysis.
- Brazil's targets achieve more than 60% of the total modeled reduction in gross deforestation in 2020; this drops to 37% in 2030 due to Brazil's declining reference level and its lack of 2030 deforestation reduction targets.
- Because of large expected peat emissions reductions from eliminating natural forest loss by 2030, Indonesia is responsible for more than two thirds of target emissions reductions in 2030.
- The DRC's ambitious 8 million hectare Bonn Challenge restoration pledge is responsible for nearly all pledged action toward ZND-2020 in Africa, though we have only included three African countries in this study.
- National policy in these three countries – Brazil, Indonesia and DRC – affects six of the 11 deforestation fronts.
- Countries analysed in Latin America, which represent 90% of the total regional deforestation, have targets that would conserve 1.8 million ha and restore 400,000 ha in 2020.
- Regional action differs substantially between 2020 and 2030 — Indonesia's New York Declaration pledge helps strengthen Asia's target over the 2020 to 2030 decade, reaching 33% of the way to ZND in 2030 (and 65% of the way to zero net emissions). Conversely, the expiration of Bonn Challenge restoration targets in 2020 set Latin America and Africa back to 40% and 14% by 2030, respectively, even though several countries in Latin America and DRC have targets of reaching ZND in 2030 as well.

The analysis presented in this report focuses on 10 of the 11 'deforestation fronts' identified by WWF. Because several of these fronts span more than one country, and multiple fronts are present within some countries, the individual country and regional findings presented here may not necessarily have one-to-one deforestation front parallels. However, the differences between regions can give us an indication of the level of government commitment to tackling forest loss close to or in the deforestation fronts.

UNSURPRISINGLY, BRAZIL, DRC AND INDONESIA DOMINATE THE RESULTS

Figure 23 summarises the 2020 impact of the conservation and reforestation commitments made by countries analysed in this report by region. Latin America is home to four of the deforestation fronts and is the region examined most comprehensively — 90% of the total net national deforestation across all net forest loss countries in the region is attributable to the seven countries selected for analysis.

Brazil is of course the most important actor, with the largest share of the region's total deforestation and biggest reduction goals in absolute area terms. If Brazil meets its targets, it alone can achieve more than a third of the action necessary to reach regional

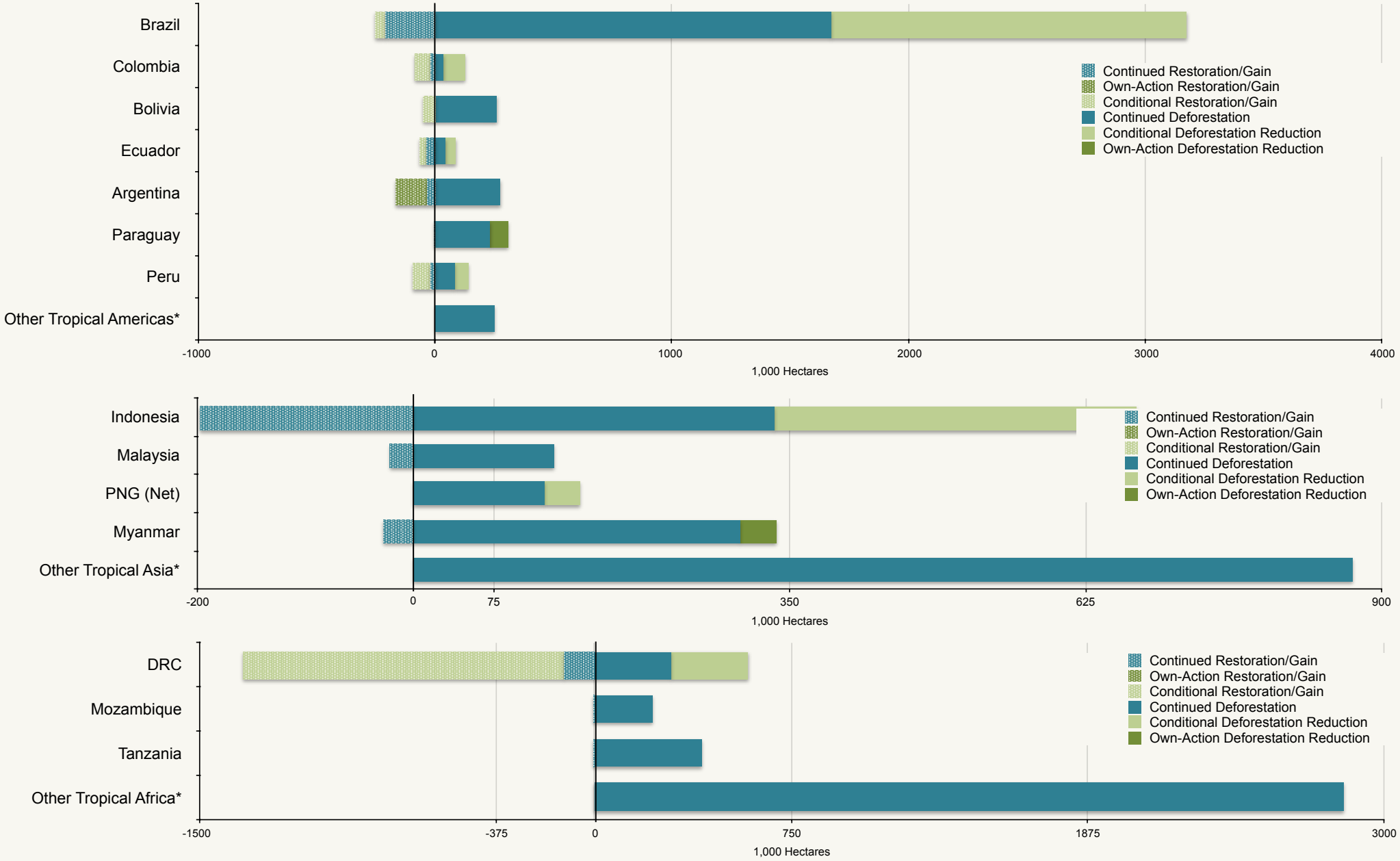
ZND-2020, and it already exceeded this target in 2012. Pledges to reduce deforestation and intensify restoration in Colombia, Bolivia, Ecuador, Argentina, Paraguay and Peru together account for about another 15%. Taken together, all of the region's commitments bring it halfway to ZND by 2020.

Within tropical Asia there were four deforestation fronts identified and the countries included in this analysis represent more than half of the total net deforestation in the region. Indonesia is the largest player, both in terms of the attributable deforestation as well as the impact of stated targets, and represents approximately 18% of the action needed to reach ZND in the region by 2020. If PNG and Myanmar successfully meet their targets and Malaysia maintains deforestation at current levels (the country has not made any conservation or restoration pledges) these three countries will bring the region another 3 percentage points closer to regional ZND-2020.

Deforestation in tropical Africa can be attributed to a host of countries and there were two widespread deforestation fronts identified in this continent. The countries included in this analysis represent just 27% of the region's total of national net forest loss. DRC is the largest, both in area as well as the scope of its commitments, although the 8 million hectare Bonn Challenge restoration pledge comprises the largest proportion of its planned action (even in the context of its NYDF pledge to reach zero natural forest loss by 2030). If DRC were to meet this restoration pledge, it would become a significant net reforesting country by a million hectares per year.

The region would be 38% of the way towards ZND in 2020 if this restoration were considered to offset net forest loss in other countries; but only 12% of the way if not. A substantial amount of additional action would be required from Mozambique, Tanzania, and other African countries not included in this analysis to reach ZND-2020.

Figure 23. Summary of conservation and reforestation commitments by region in 2020 (see Table 3 for details).



*Sum of FAO estimates of 2000-2010 net forest for all countries with net forest loss, and excluding countries with net forest gain.

PAN-TROPICAL FOREST COMMITMENTS AND OPPORTUNITIES

Pan-tropical findings in brief:

If fully financed and achieved, we estimate that existing targets in 14 forest countries representing over half[119] of tropical forest area loss would:

- Reduce total annual net forest loss across deforesting tropical countries by 30% in 2020 (3.0 million hectares) and 28% in 2030 (2.7 million hectares), compared to projected forest loss.

- Reduce net forest loss by 40% in 2020 (4.1 million hectares) if it includes hectares of forest restored that goes beyond net zero forest loss in Colombia, DRC, Ecuador and Peru. The DRC in particular has a very ambitious target for forest restoration. However, this figure allows forest loss in one country to be offset by forest cover gain in another.

- Altogether, result in a reduction of 1.9 Gt CO2 (40%) in net forest-related emissions in 2020 and 2.7 Gt CO2 (53%) in 2030 compared to the reference scenario. Over half of the 2030 reduction is from NYDF signatory countries.

- Achieve 1.6 million hectares of forest restoration per year in 2020. This drops off significantly in the following decade, as the Bonn Challenge targets have yet to be extended by most countries.

- Leave significant remaining forest loss in 2020 beyond the analysed pledges. A total of 7.2 million ha of net deforestation is expected to remain across tropical countries losing forest in 2020 – down 22% from 2000-2010 (9.3 million ha) and 29% from the 2020 reference level (10.2 million ha).

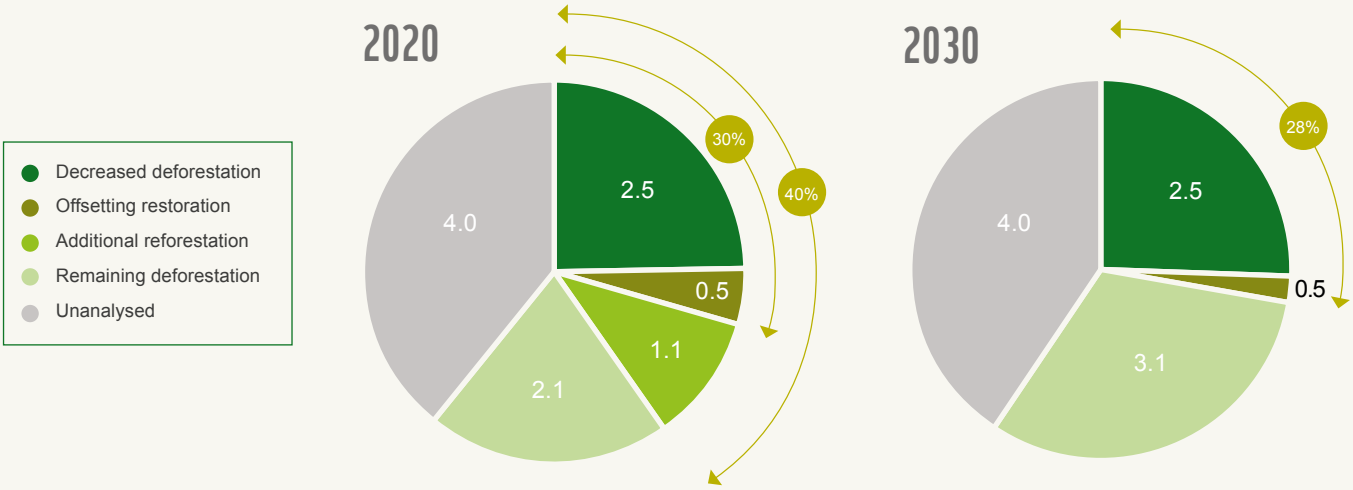
- Be supported – or even exceeded – by zero-deforestation supply chain pledges. As analysed for Brazil and Indonesia, such pledges could impact a similar or even greater scale of forest area and emissions as government pledges. However, it is not possible to estimate the interactions between supply chain and government pledges, and the impacted areas would overlap significantly.

A summary of the figures per country and region for 2020 and 2030 are found in tables 3 and 4 at the end of this report.

THE TARGETS ANALYSED WOULD REDUCE ANNUAL FOREST LOSS IN DEFORESTING TROPICAL COUNTRIES BY 30% IN 2020 AND 28% IN 2030

Forest loss across the tropical region over the 2000-2010 period was 9.3 million hectares – the sum of national-level net forest loss for those countries losing forest on balance. In the reference case, the projected loss of forests would reach 10.2 million hectares and 9.7 million hectares in 2020 and 2030, respectively. If the pledges and commitments analysed here are fully realised, they can reduce pan-tropical deforestation by 40% in 2020 and 31% in 2030 (Figure 24). If we exclude restoration that goes beyond net zero at national level (in the case of Colombia, DRC, Ecuador and Peru) then deforestation is reduced by 3 million hectares (30%) in 2020. Excluding this restoration avoids offsetting forest loss in one country with forest gain in another.

Figure 24. Target changes in forest area in 2020 and 2030 for all tropical net forest loss countries.



Note: All figures in million hectares (ha). Full pie represents the sum of net deforestation for all countries in the sample and for all other unanalysed tropical countries with net forest loss from 2000-2010 (i.e. excluding net reforesting countries). See Methodology section above for details. The reference for the 2000-2010 period is 9.3 million hectares, for 2020 is 10.2 million hectares and in 2030 is 9.7 million hectares.

Looking solely at the countries included in this analysis, the deforestation and reforestation commitments reduce their projected collective forest loss by two-thirds in 2020 and by slightly less than half in 2030. Unanalysed sources of deforestation in the tropics represent about 40% of the total net deforestation in both years[120].

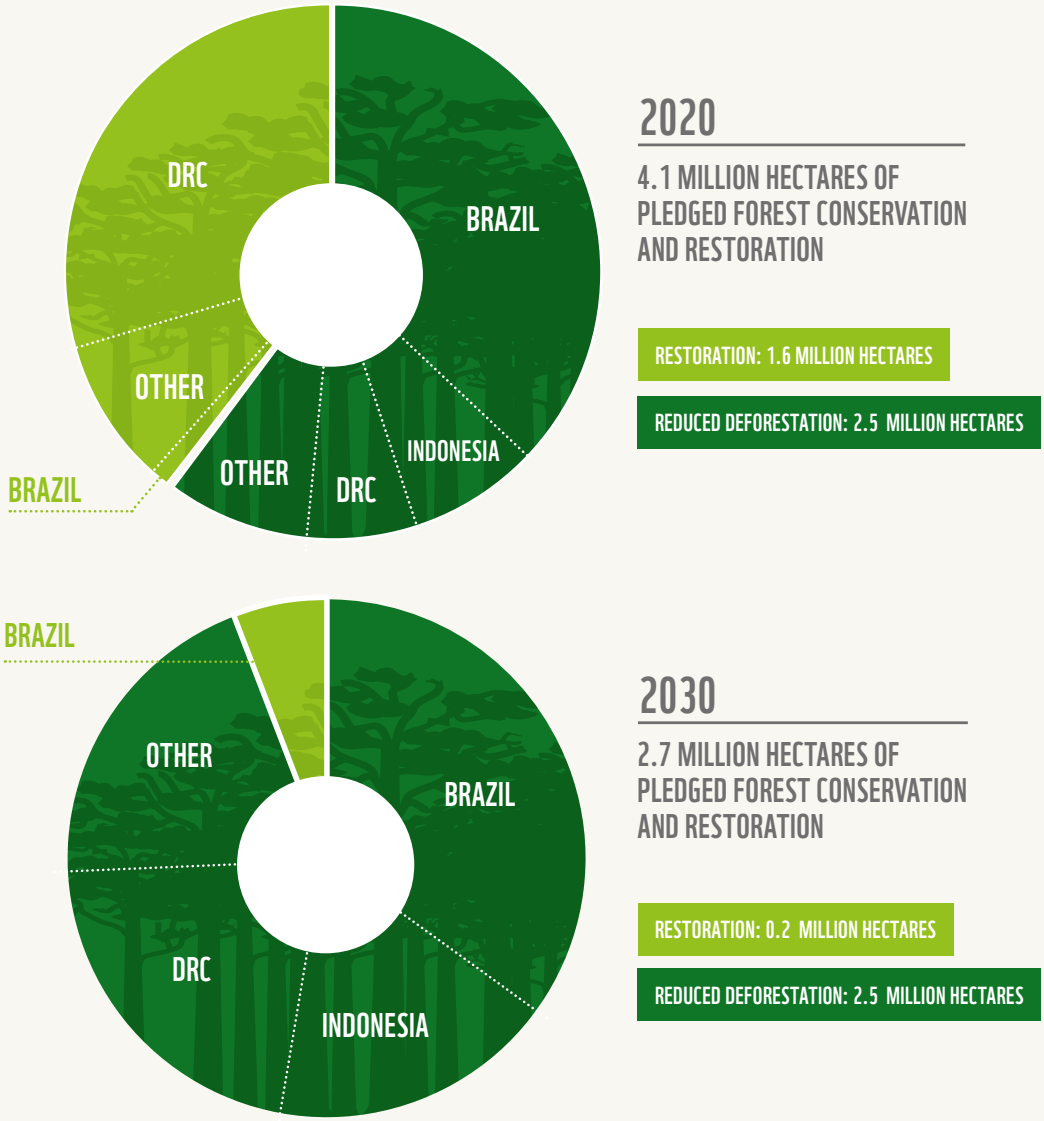
In 2020, the total pledged decline in net deforestation can be attributed to both a reduction in forest loss (2.5 million hectares) as well as significant restoration (1.6 million) (Figure 25). Brazil is the principal driver of decreases in deforestation, representing 61% of all pledged reductions. Pledges from Indonesia and the DRC account for another 25% of the total area of forests preserved. The reforestation area is driven almost completely by DRC's Bonn Challenge restoration pledge.

Unlike 2020, the 2030 decreases in net deforestation are primarily attributable to commitments to reduce deforestation rather than restored forests. Of the 2.5 million hectares preserved, Brazil's pledges again comprise the largest country contribution at 37%. While that of the DRC and Indonesia represent 19% and 23% respectively. The 0.2 million ha of restored forests in 2030 is from Brazil's Atlantic Forest Pact, the only restoration pledge identified that continued past 2020.

It is absolutely critical to emphasise that nearly all of the commitments examined here have been put forward as conditional on international finance. This study was generally unable to estimate the amount or ambition of forest country 'own-action' represented by existing pledges. National-scale forest reference emissions levels (FRELs) are not available for most countries, and the setting of FRELs is a challenging and contested process.

Commitments clearly attributable to own-action represent just 71,000 hectares of reduced deforestation and 130,000 hectares of restored forest – or 5% of the total area conserved and restored in 2020. These are Paraguay's land conversion moratorium for the Oriental region, and the restoration pledge from a non-governmental foundation – Conservación Patagónica – in Argentina. Paraguay's commitment is the only one that extends through 2030. In other words, up to 95% of the effort represented in these targets for both 2020 and 2030 could be conditional on international finance.

Figure 25. Total targeted reductions in deforestation and restored forests in 2020 and 2030.
Note: Full pie represents the total hectares conserved and reforested from pledges.



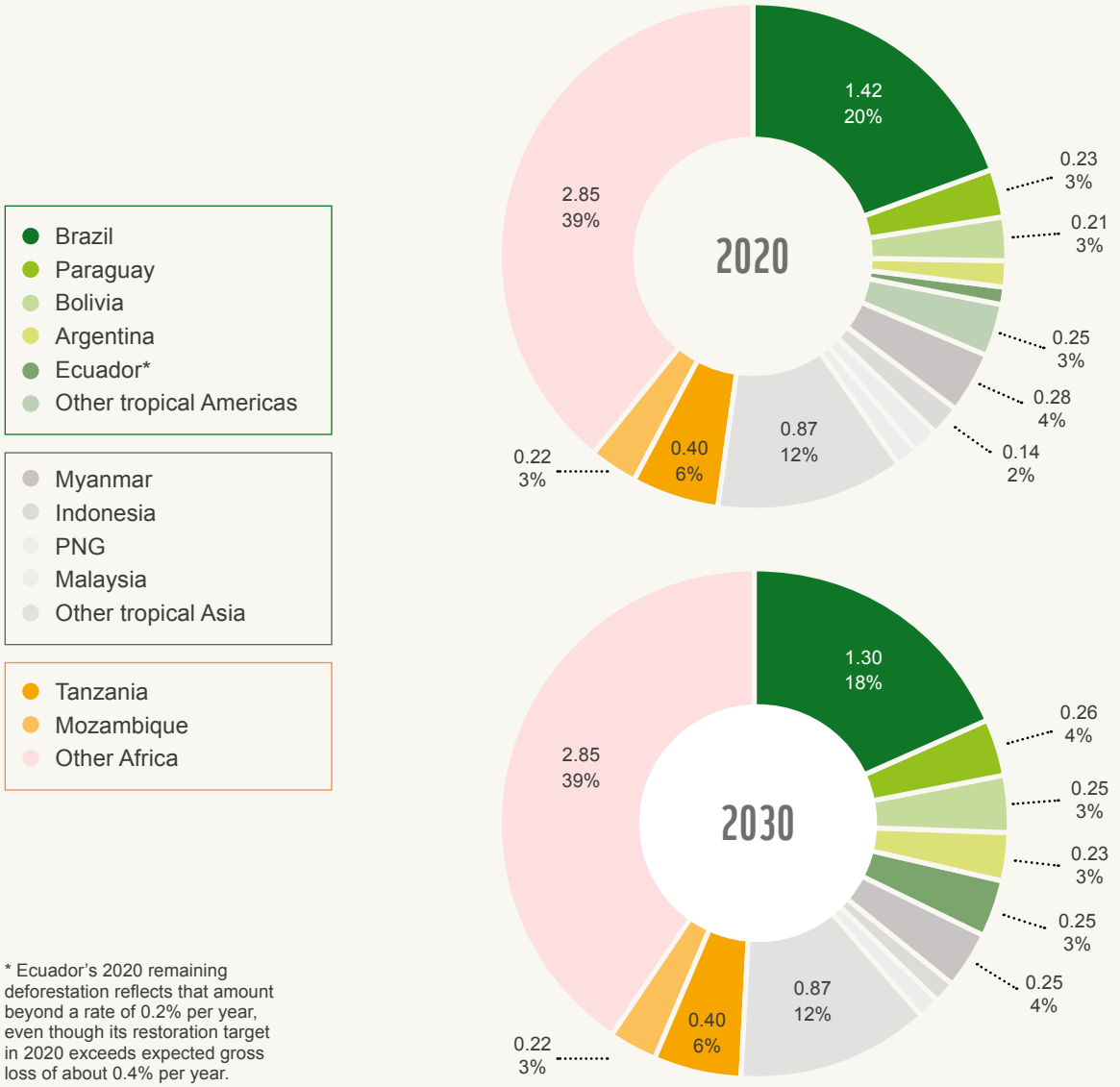
Notwithstanding the substantial commitments made thus far, tremendous opportunity remains to strengthen commitments to reduce deforestation in the tropics. A total of 7.3 million hectares of net deforestation is expected to remain across those tropical countries losing forests in 2020 – down 22% from 2000-2010 (9.3 million hectares) and 28% from the 2020 reference level (10.2 million ha). (Figure 26). The remaining net loss in 2030 is expected to be 7.05 million hectares, down 24% from historical and 27.5% from the 2030 reference level (9.7 million hectares).

Africa represents the largest proportion of remaining forest loss both in 2020 and 2030, approximately 48% and 49%, respectively. Close to 3.5 million hectares are expected to be lost in Africa in 2020, assuming somewhat increasing loss in countries outside the sample and stable loss of about 60,000 ha per year in Tanzania and Mozambique; achieving ZND on the continent will require significant action by these and other African countries not included in this analysis[121]. It is worth noting that some countries have already come forward with commitments, conditional on international finance. For example, Ethiopia, Rwanda and Uganda have made restoration commitments under the Bonn Challenge.

Latin America accounts for 31% of the remaining opportunity to achieve ZND in 2020. With a target in the range of 1.42 million hectares of forest loss remaining in 2020, Brazil would continue to be the largest single deforester in the region — and globally. Remaining sources of deforestation — the largest of those analysed here being Paraguay, Bolivia and Argentina — together represent another 8% and 10% of the opportunity to reach ZND in 2020 and 2030 respectively.

Finally, persisting deforestation in Asia represents 21% and 18% of the total opportunity to reach ZND in tropical forest countries in 2020 and 2030, respectively. With some target reductions for 2030 in Myanmar and PNG, and the NYDF 2030 ZND target of the region's largest current deforester (Indonesia), the four Asian countries in our sample would drop from 67% of the region's forest loss in the 2000-2010 period to 33% in 2030.

Figure 26. Remaining forest loss to reach ZND after existing targets by country and region, 2020 and 2030. These diagrams illustrate to what extent targets could be strengthened with policy ambition and international support to reach ZND. Note that Colombia, Ecuador, Peru and DRC do not appear in either year, and Indonesia drops off in 2030, as these countries' targets exceed ZND in those years.



* Ecuador's 2020 remaining deforestation reflects that amount beyond a rate of 0.2% per year, even though its restoration target in 2020 exceeds expected gross loss of about 0.4% per year.

RECOMMENDATIONS

The core findings of this analysis are that forest countries have set significant deforestation reduction and forest restoration targets conditional on international finance, but not enough to reach ZND in the tropics by 2020 or 2030. There is a need to significantly increase collective ambition to protect forests.

The world is in a collective ambition-setting moment. As outlined above, there is an immediate opportunity to achieve this through the UNFCCC process leading (we hope) to an international climate agreement in 2015; through the already emerging discussions of how the world will close the emissions ambition gap that will inevitably remain; and through the agreement of forest-related targets in the Sustainable Development Goals.

MANY OF THE COUNTRIES IN THIS SAMPLE HAVE SET AMBITIOUS DEFORESTATION TARGETS WITH HUGE EMISSIONS SAVINGS. BUT THEY ARE CONDITIONAL ON INTERNATIONAL FINANCE

The primary vehicle for countries to express their climate pledges – the intended nationally determined contributions (INDCs) each country has committed to advancing by October 2015 – has moved domestic ambition forward while leaving collective ambition behind. The largest emitters – the US, China and the EU – have advanced INDCs that provide few if any incentives to developing countries for cutting emissions more than they might otherwise.

More international cooperation on mitigation is clearly needed. Even optimistic scenarios of the 2015 international climate negotiations expect a large mitigation gap to remain, if not grow[122]. While the bottom-up (nationally-determined action) approach to the climate agreement currently being pursued is necessary to reach an agreement, it has failed so far to generate clear incentives from developed economies to reduce future emissions where they will grow most: developing and emerging economies.

As this study reinforces, one of the best opportunities for increased mitigation is in forest countries. These countries have set significant and ambitious deforestation goals for themselves to reduce deforestation and restore forests, potentially achieving 1.9 Gt CO_2e reductions by 2020 and 2.8 Gt CO_2e by 2030. Developed countries should match or exceed the deforestation reduction and forest restoration ambition advanced by these developing and emerging forest nations with strong domestic forest targets of their own as part of their overall mitigation commitments.

Developed countries should also strengthen their domestic commitments by adding a second commitment: to achieve, in partnership with tropical forest countries, a fixed amount of additional mitigation by slowing and reversing forest loss in those tropical countries. Such 'dual commitments' would significantly close the mitigation gap. For example, achieving the NYDF targets (reaching zero natural forest loss and initiating restoration of 350 million hectares of forest by 2030) would keep 4.5 to 8.8 Gt CO_2 per year out of the atmosphere in 2030, mostly in developing countries. This action alone would close between 17 and 33% of the entire gap between business as usual and two degrees.

The New York Declaration must, therefore, be a focus in 2015. More countries should join the growing international consensus it represents, sign up to the goals it sets out, and work to identify collective actions across both developed and developing countries to pursue its goals. Notably, only one country in our sample has a restoration pledge that stretches beyond 2020 – the year after which the NYDF calls for acceleration.

At least the same amount of ambition as the NYDF must be enshrined in the climate change deal and the SDGs, while noting that greater ambition is both possible and needed. It has been shown that achieving ZND a decade sooner than called for in the

NYDF could save 24GtCO2e of emissions – a big prize in comparison to the mitigation gap that currently exists to a 2 degree pathway[123,124].

The world cannot allow this opportunity to slip away. The following recommendations outline the political leadership steps needed to realise a zero net deforestation future.

As countries finalise their position ahead of the Paris climate summit, and plan to respond at national level to the Sustainable Development Goals, we call for:

As countries finalise their position ahead of the Paris climate summit, and plan to respond at national level to the Sustainable Development Goals, we call for:

1. **All countries to agree a universal commitment to the goals set out in the New York Declaration on Forests, including cementing at least the same level of ambition in the SDGs.**
2. **Countries with higher capability to pledge support to those forest nations who have already set targets equivalent to or close to ZND in 2020 or 2030. And to demonstrate willingness to do the same for others.**
3. **All countries whose forests play a major role in their emissions to include a time-bound commitment to Zero Net Deforestation and Zero Net Emissions from forests, including achieving near zero natural forest loss.**

In practice, this will require the following steps:

a) Developing forest nations to lay the foundations for their own action and potential partnerships by clearly quantifying against an explicit baseline:

- the national emissions reductions they will achieve on their own from forests;
- the additional forest emissions reductions they would achieve with international support; and
- the relationship they expect to see between emissions reductions in the forest sector and rates of forest area loss and restoration, considering in some cases setting targets for both.

b) Parties with higher responsibility and higher capability to:

- set ambitious domestic economy-wide mitigation targets including forests, and
- pledge an additional mitigation target to be achieved through partnerships with developing countries, including finance and other support.

c) Parties with higher responsibility and higher capability, International Financial Institutions, the Green Climate Fund and other actors to:

- significantly accelerate financing for forest protection pre-2020 to support delivery against the ambitious conditional commitments already tabled by forest nations.
- acknowledge the differences in national policy commitments and the unequal coverage of deforestation risk areas by these commitments, rightly rewarding the ambitious and encouraging and enabling ambition where it is currently absent.

The above steps provide a specific framework for translating global climate ambition and international Sustainable Development Goals into ambitious deforestation reduction goals. They would set the world on the path to a zero-deforestation future and create a clear structure for advanced economies to partner with forest countries to provide the financing needed to achieve it.

An afterword on designing national forest targets

Setting goals is a critical step, but it will be difficult to pursue them, fund them, and assess success or failure in reaching them without clarity as to exactly what they mean. Such clarity on many of the forest goals set to date is lacking. While this was not one of our objectives when our research began, several potential pitfalls and risks emerged as we collated forest loss and emissions statistics and targets and tried to interpret the latter in the light of the former. These risks could threaten the ability of forest countries to manage their forests as planned, let alone successfully attract financing through a climate agreement.

This report identifies the following information and communication challenges that require attention as we work towards setting and meeting aggressive forest goals:

1. **Lack of transparency on baselines.** Countries setting targets against a 'business as usual' baseline need to communicate sufficiently complete information (data sources, methods of calculation) for other parties to be able to reproduce the baseline. Links or references to data sources are needed.
2. **Unclear relationship between forest emissions and forest area targets**. In complex landscapes, there is not a simple direct relationship between forest area loss and forest emissions. For example, Indonesia's very significant emission reduction targets could theoretically be met successfully with continued forest area loss. While extreme, the example draws attention to the need for countries to define their goals in both area and emissions.
3. **Mixed messages on targets.** A new target may be a restatement, replacement, extension, or subset of existing targets. Countries should seek to place any new targets explicitly in the context of previous targets that may have been set in different contexts (UNFCCC, CBD, NYDF, domestic law).
4. **Mixed messages from different data sources.** None of the readily available data on deforestation area and emissions is perfect. Even when there are good reasons for differences, the mixed messages can make forest targets seem poorly constrained.
5. **Net versus gross, and interactions with restoration.** Countries should be clear on whether deforestation area and emissions targets are set on a net versus gross basis. Net deforestation targets and baselines would ideally be broken down into gross forest loss and forest restoration or regrowth targets, especially in areas where significant restoration action could combine with significant natural forest loss to result in something that looks like zero net deforestation – but really isn't.
6. **Regional and biome-scale targets lacking national context.** Paraguay exemplifies the challenges of a country with a zero-deforestation target for a particular region or biome, but lacking a national level target. Its zero-deforestation law for the Atlantic Forest Region has been successful in protecting some forests, but forest loss outside that region has been accelerating.
7. **Lack of geographic information on areas included or excluded from targets.** Malaysia has proposed a Forest Reference Emission Level for the area of its permanent forest reserve. Without geographically explicit map data on the extent and location of areas included or excluded in the permanent forest reserve, it is very difficult for external data to inform Malaysia's performance on its FREL.
8. **Forest degradation could be looming**. It is difficult to measure and monitor forest degradation; many countries are likely to exclude the process from targets for the foreseeable future. However, there is some evidence that degradation is extensive and the source of significant carbon emissions. Countries should work towards full accounting for all forest processes as soon as practicable.

Table 3. Summary of 2020 Targets (thousand hectares)

	2020				2030			
	Reference – Net Loss	Pledges – Reduced Loss	Pledges – Increased Gain	Target – Net Loss	Reference – Net Loss	Pledges – Reduced Loss	Pledges – Increased Gain	Target – Net Loss
Brazil	2965.67	1501.53	-41.59	1422.55	2393.04	928.90	-166.59	1297.55
Colombia	112.61	91.17	-68.25	-46.81	112.61	112.61	0.00	0.00
Bolivia	261.00	0.00	-51.75	209.26	261.00	0.00	0.00	261.00
Ecuador	54.92	44.75	-32.10	-21.92	54.92	72.21	0.00	-17.28
Argentina	245.05	0.00	-136.67	108.38	245.05	0.00	0.00	245.05
Paraguay	306.07	78.56	0.00	227.52	306.07	78.56	0.00	227.52
Peru	123.86	56.57	-75.75	-8.45	123.86	92.20	-32.08	-0.42
Other Tropical Americas	250.63			250.63	250.63			250.63
Indonesia	473.98	335.99	0.00	137.99	473.98	473.98	0.00	0.00
Malaysia	109.05	0.00	0.00	109.05	109.05	0.00	0.00	109.05
PNG	154.97	32.85	0.00	122.12	174.99	98.55	0.00	76.45
Myanmar	309.52	33.78	0.00	275.74	309.52	64.18	0.00	245.33
Other Tropical Asia*	872.78			872.78	872.78			872.78
DRC	465.91	290.98	-1217.28	-1042.35	568.70	568.70	0.00	0.00
Mozambique	215.73	0.00	0.00	215.73	215.73	0.00	0.00	215.73
Tanzania	403.40	0.00	0.00	403.40	403.40	0.00	0.00	403.40
Other Africa	2845.92			2845.92	2845.92			2845.92
Total analysed	6201.75	2466.17	-1623.38	2156.95	5751.93	2489.88	-198.67	3063.38
Total not analysed	3969.33			3969.33	3969.33			3969.33

* excluding China

Table 4. Summary of 2030 Emissions Targets (million tonnes CO2e)

	Reference – Net Loss	Pledges – Reduced Loss	Pledges – Increased Gain	Target – Net Loss
Brazil	687.27	256.17	-112.73	318.36
Colombia	66.49	63.75	-11.35	-8.61
Bolivia	74.33	0.00	0.00	74.33
Ecuador	31.06	27.47	-4.36	-0.76
Argentina	64.27	0.00	0.00	64.27
Paraguay	30.07	7.55	0.00	22.52
Peru	52.68	39.22	-19.85	-6.39
Indonesia	1975.89	1679.69	0.00	296.20
Malaysia	123.65	0.00	0.00	123.65
PNG	52.97	29.83	0.00	23.14
Myanmar	59.00	0.00	0.00	59.00
DRC	34.08	402.73	-102.42	-471.06
Mozambique	33.14	0.00	0.00	33.14
Tanzania	89.23	0.00	0.00	89.23

REFERENCES & ENDNOTES

1. Ciais et al. 2013. *Carbon and Other Biogeochemical Cycles,* in Climate Change 2013: The Physical Science Basis,contribution of Working Group I to the Fifth Assessment Report of the IPCC.
2. IPCC 2014. *Climate Change 2014: Mitigation of Climate Change. Intergovernmental Panel on Climate Change*, AR 5, Working Group III.
3. Busch and Seymour 2014. *Why Forests? Halting Deforestation is Essential for Climate Stability*. www.cgdev.org/sites/default/files/why-forests-why-now-10-14-14_0.pdf.
4. Wolosin (2014). Quantifying the Benefits of the New York Declaration on Forests.
5. UNEP (2014). *The Emissions Gap Report 2014*. United Nations Environment Programme (UNEP), Nairobi.
6. Stolton, S and N. Dudley [eds.] (2010) in *WWF Living Forest Report*. 2011. Chapter 1. Forests for a living planet. Page 6.
7. TEEB, 2009b in Convention of Biological Diversity (Secretariat). Technical Series No. 59. 2011. REDD-plus and Biodiversity
8. FAO, State of the World's Forests 2014.
9. FAO. 2010. Global Forest Resources Assessment (FRA). Food and Agriculture Organisation of the United Nations, Rome. www.fao.org/docrep/013/i1757e/i1757e.pdf
10. Hansen et al. 2013.; www.wri.org/blog/2015/04/tree-cover-loss-spikes-russia-and-canada-remains-high-globally.
11. e.g., Kim et al 2014. *Global, Landsat-based forest-cover change from 1990 to 2000*; news.mongabay.com/2015/0320-commentary-remote-sensing-macdicken-tubiello.html and www.cgdev.org/blog/disruptive-data-disputes-documentationdeclining-deforestation.
12. Taylor, R. (ed.). 2015. *WWF Living Forests Report*. Chapter 5: Saving Forests at 12 Risk. wwf.panda.org/livingforests, WWF, Gland, Switzerland.
13. REDD+, or Reducing Emissions from Deforestation and Forest Degradation, is used to mean various things, most notably the goal of reducing emissions from deforestation and degradation, and a mechanism under the UNFCCC that is being negotiated. We minimise use of the term except when citing work that defines is specifically. Lawson, S 2014. Consumer Goods anddeforestation: An analysis of the extent and nature of illegality in forest conversion for agriculture and timber plantations.
14. Taylor, R. (ed.). 2015. *WWF Living Forests Report*. Chapter 5: Saving Forests at Risk. wwf.panda.org/livingforests, WWF, Gland, Switzerland.
15. Climate and Land Use Alliance. 2014. Disrupting the Global Commodity Business. www.climateandlandusealliance.org/uploads/PDFs/Disrupting_Global_Commodity.pdf
16. New York Declaration on Forests. Available from: www.un-redd.org/portals/15/documents/ForestsDeclarationText.pdf.

17. Aichi Target 5: *By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.* Aichi Target 15: *By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.* Available from: www.cbd.int/sp/targets.

18. Sustainable Development Knowledge Platform. *Open Working Group proposal for Sustainable Development Goals*. Available from: sustainabledevelopment.un.org/focussdgs.html.

19. www.un.org/pga/wp-content/uploads/sites/3/2015/05/070515_intergovernmental-negotiations-post-2015-devagenda.pdf. Accessed 8 May 2015

20. Taylor, R. (ed.). 2011. *WWF Living Forests Report. Chapter 1: Forests for a Living Planet*. wwf.panda.org/livingforests, WWF, Gland, Switzerland

21. Taylor, R. (ed.). 2015. *WWF Living Forests Report*. Chapter 5: Saving Forests at Risk. wwf.panda.org/livingforests, WWF, Gland, Switzerland.

22. Government of Mexico. March 30, 2015. *Intended Nationally Determined Contribution*. Available at: www4.unfccc.int/submissions/INDC/Published Documents/Mexico/1/MEXICO INDC 03.30.2015.pdf

23. Republic of Gabon. March 31, 2015. *Contribution prévue déterminée au niveau national – Conférence des Parties 21*. Available at: www4.unfccc.int/submissions/INDC/Published%20Documents/Gabon/ 1/20150331%20INDC%20Gabon.pdf

24. Colombia, Chile, Costa Rica, the Democratic Republic of the Congo, Dominican Republic, Ethiopia, Guatemala, Guyana, Liberia, Nepal, Panama, Paraguay, Peru and the Philippines.

25. Dahl-Jorgensen, A. 2014. *Forest Countries Challenge World to Increase Climate Ambition*. Available from: www.climateadvisers.com/forest-countries-challenge-world-to-increase-climate-ambition.

26. Brazil, Colombia, Costa Rica, Democratic Republic of the Congo, El Salvador, Ethiopia, Guatemala, Rwanda, Uganda, and United States of America have made individual pledges, while Chile, Ecuador, Mexico, Peru,, and the organisation Conservacion Patagonica operating in Argentina and Chile joined together in November 2014 to announce Initiative 20x20, a restoration effort expected to contribute 11.1 million hectares to the Bonn Challenge. www.bonnchallenge.org

27. Joint Statement on REDD+ By Germany, Norway, and the United Kingdom. 23 Sep 2014. United Nations Climate Summit. Available from: www.regjeringen.no/globalassets/upload/md/2014/gnu-joint-statement-for-sg-summit-23092014.pdf.

28. Norman, M. and S. Nakhooda. 2014. *The State of REDD+ Finance*. CGD Working Paper 378. Washington, DC. Center for Global Development. Available at: www.cgdev.org/publication/state-redd-finance-working-paper-378

29. ibid

30. Based on FAO data. With Hansen tree cover figures, the 14 countries represent 61% of tropical forest cover.

31. Pearson et al. 2014. Carbon emissions from 31 tropical forest degradation caused by logging.

32. One recent synthesis identified three independent sources of tropical deforestation and degradation emissions estimates, with relatively consistent estimates for deforestation, but with degradation emissions ranging from 2.2 Gt CO2 per year to 5.4 Gt CO2 per year (43- 64% of the total emissions from deforestation and degradation). Mercer, B. 2015. *Tropical Forests: A Review*. The Prince's Charities International Sustainability Unit.

33. FAO recently estimated that global degradation emissions have increased from about 400 million metric tonnes CO2/yr in the1990s to about 1 gigatonne annually from 2001-2015, and now make up one quarter of net forest emissions. FAO (2015), FAO assessment of forests and carbon stocks, 1990-2015. www.fao.org/3/a-i4470e.pdf

34. WRI's Global Forest Watch compiles several such sources into a single forest monitoring tool. Available at: globalforestwatch.org

35. One example is the wide range of forest sector emissions estimates for the Democratic Republic of the Congo (DRC). Data sources that model forest and land use emissions based on fire emissions data suggest Land Use Change and Forestry emissions of around a gigatonne per year; a rough conversion of tree cover loss estimated by Hansen et al (2013) suggests emissions on the order of 250 million tonnes per year; while the DRC's reporting to the UNFCCC suggests that its forests are a significant net sink of a similar scale rather than a net source.

36. FAO.2010. *Global forest resources assessment 2010 - Terms and Definitions*. Available from: www.fao.org/docrep/014/am665e/am665e00.pdf.

37. Hansen, M.C., P.V. Potapov, R. Moore, M. Hancher, S.A. Turubanova, A. Tyukavina, D. Thau, S.V. Stehman, S.J. Goetz, T.R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C.O. Justice, and J.R.G. Townshend. 2013. High-resolution global maps of 21stcentury forest cover change. Science 342(6160): 850-853.

38. Elias, P., Ellis, P, and Griscom, B. 2014. Applicability of the Hansen Global Forest Data to REDD+ Policy Decisions. www.conservationgateway.org/ConservationPractices/ClimateChange/ForestCarbon/ Documents/tnc_REDD+_Hansen.pdf

39. Saatchi, S., Harris, N., Brown, S., et al. 2011. Benchmark map of forest carbon stocks in tropical regions across three continents. Available from: www.pnas.org/cgi/doi/10.1073/pnas.1019576108.

40. Potapov, P., Laestadius, L., and Minnemeyer, S.. 2011. Global map of forest landscape restoration opportunities. World Resources Institute: Washington, DC.

41. WRI, CAIT 2.0. 2015. Climate Analysis Indicators Tool: WRI's Climate Data Explorer. Washington, DC: World Resources Institute. Available from: cait2.wri.org.

42. European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR), release version 4.2.

43. UNEP, 2014 The Emissions Gap Report 2014. United Nations Environment Program (UNEP).

44. See Appendix 1 to this report for compiled data, available online.

45. Sizer, N. et al. April 02, 2015. *Tree Cover Loss Spikes in Russia and Canada, Remains High Globally*. Available at: www.wri.org/blog/2015/04/tree-cover-loss-spikes-russia-and-canada-remains-high-globally

46. See Appendix 2 to this report for full country list, available online.

47. Soares-Filho, Britaldo, Raoni Rajão, Marcia Macedo, Arnaldo Carneiro, William Costa, Michael Coe, Hermann Rodrigues,and Ane Alencar. Cracking Brazil's forest code. Science 344, no. 6182 (2014): 363-364.

48. Ibid.

49. Nepstad, D., McGrath, D., Stickler, C., Alencar, A., Azevedo, A., Swette B., Bezerra, T. et al. Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. Science 344, no. 6188 (2014): 1118-1123.

50. The area defined officially by the Government of Brazil as the Amazon region.

51. See Appendix 1 to this report for more information, available online.

52. Bonn Challenge. Brazil's Atlantic Forest Restoration Pact. Available from: www.bonnc 52 hallenge.org/content/brazilsatlantic-forest-restoration-pact.

53. Atlantic Forest Restoration Pact. Available from: pactomataatlantica.org.br/missao-e-objetivo.aspx?lang=en.

54. Brazil House of Representatives. 2010. Decree No. 7,390. Documentation and Information Centre. Available from: www2.camara.leg.br/legin/fed/decret/2010/decreto-7390-9-dezembro-2010-609643-normaatualizada-pe.html

55. No other post-2020 targets were identified, so no additional forest loss reductions were assumed for the target pathway.

56. The area defined officially by the Government of Brazil as the Amazon region.

57. Federal Republic of Brazil. 2010. Letter including nationally appropriate mitigation actions. TS. UNFCCC. Berlin, Germany.Available from: unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/brazilcphaccord_app2.pdf.

58. Note that this sequestration rate is on the high end, but the analysis is not sensitive to the assumption. The emissions payoff from restoration is long-term, as Figure 3 makes clear: the near term restoration sink is an order of magnitude smaller than both gross forest loss emissions and the continued natural sink from Brazil's massive forest area.

59. Federal Republic of Brazil. 2010. Letter including nationally appropriate mitigation actions. TS. UNFCCC. Berlin, Germany. Available from: unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/brazilcphaccord_app2.pdf.

60. Republic of Brazil. Jun 2014. Brazil's submission of a forest reference emission level for deforestation in the Amazonia biome for results-based payments for REDD+ under the UNFCCC. Brasilia. Available from: www.mma.gov.br/redd/images/Publicacoes/FREL_Complete_October31_FINAL.pdf

61. Governors' Climate & Forests Task Force (GCF). 2014. Rio Branco Declaration. Available from: www.gcftaskforce.org/documents/2014_annual_meeting/GCF_RioBrancoDeclaration_August_5_2014_EN.pdf.

62. Grieg-Gran, M. 2008. The cost of avoiding deforestation: Update of the report prepared for the Stern Review of the Economics of Climate Change. Available from: digital.library.unt.edu/ark:/67531/metadc13712/m2/1/ high_res_d/IIED_opportunity_costs_modelling.pdf.

63. INPE. 2011. Executive Summary in Levantamento de informações de uso e cobertura da terra na Amazônia. National Institute for Space Research, Belém, Brazil. Available from: www.inpe.br/cra/projetos_pesquisas/sumario_executivo_terraclass_2008.pdf.

64. Lawson, S 2014. Consumer Goods and deforestation: An analysis of the extent and nature of illegality in forest conversion for agriculture and timber plantations.

65. Walker, N. F., Sabrina A. P., and Kemel A.B.K. 2013. *From Amazon Pasture to the High Street: Deforestation and the Brazilian Cattle Product Supply Chain* Tropical Conservation Science, Special Issue 6 (3): 446-467. Available from: tropicalconservationscience.mongabay.com/content/v6/TCS-2013_Vol_6(3)_446-467-Walker_et_al.pdf.

66. Gibbs, H. K., Munger, J., L'Roe, J., Barreto, P., Pereira, R., Christie, M., Amaral, T. and Walker, N. F. 2015. Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the Brazilian Amazon? Conservation Letters. doi: 10.1111/conl.

67. Hansen, et al. 2013. High-resolution global maps of 21st-century forest cover change. Science 342(6160): 850-853.

68. Margono, B. A., Potapov, P.V., Turubanova, S., Stolle, F., and Hansen, M.C.. 2014. Primary Forest Cover Loss in Indonesia over 2000–2012. Nature Climate Change 4: 730-735. doi: 10.1038/NCLIMATE2277.

69. Government of Indonesia. Dec 2014. Submission by Indonesia National Forest Reference Emission level for Deforestation and Forest Degradation in the Context of the Activities Referred to in Decision 1/CP.16, Paragraph 70 (REDD+) Under the UNFCCC. Jakarta, Indonesia.

70. It is important to note that the Indonesian Constitutional Court decided two years ago that Indonesia's national forest laws needed to be changed to ensure effective recognition of customary land rights in forests. While not a national target, and thus not included in this analysis, this ruling could have significant impact on the future of Indonesia's forest lands – the National People's Indigenous Organisation (AMAN) has estimated that the ruling affects 40 million hectares of forest.

71. This sub national analysis is based on province-level statistics from Hansen e 71 t al 2013 as extracted from GFW 2.0, for 30% forest cover.

72. Retno Gumilang Dewi, et. Al. Nov 2010. Indonesia Second National Communication Under The UNFCCC. Jakarta. Available From: unfccc.int/files/national_reports/non-annex_i_natcom/submitted_natcom/application/pdf/indonesia_snc.pdf

73. Potapov, P. et al. 2011. Global map of forest landscape restoration opportunities. World Resources Institute: Washington, DC.

74. See Appendix 1 to this report for more information, available online.

75. The UNEP estimates are based on large-scale biomass burning, similar to the AR5 approach, and are derived from the same underlying dataset of fire activity as van der Werf (2007).

76. Witoelar, R. 2010. Indonesia's Plan to Reduce GHG Emission. National Council on Climate Change. Jakarta, Indonesia. Available From: unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/indonesiacphaccord.pdf

77. Boucher, D., Elias, P., Lininger, K., May-Tobin, C., Roquemore, S., and Saxon, E. 2011. The Root of the Problem: What's Driving Tropical Deforestation Today? Union of Concerned Scientists, Tropical Forest and ClimateInitiative, Cambridge, MA. Available from: www.ucsusa.org/assets/documents/global_warming/UCS_RootoftheProblem_DriversofDeforestation_FullReport.pdf.

78. Climate and Land Use Alliance (2014). Disrupting the Global Commodity Business. Available from: www.climateandlandusealliance.org/en/Global_Commodity_Business

79. Carlson, K. M., Curran, L. M., Ratnasari, D., Pittman, A. M., Soares-Filho, B. S., Asner, G. P., ... & Rodrigues, H. O. (2012). Committed carbon emissions, deforestation, and community land conversion from oil palm plantation expansion in West Kalimantan, Indonesia. Proceedings of the National Academy of Sciences, 109(19), 7559-7564.

80. Potapov, P. et al. 2011. Global map of forest landscape restoration opportunities. World Resources Institute: Washington, DC.

81. Whitehouse, Simon. Jun 2014. Submission of Draft Letter of Intent: Potential Purchase of Emission Reductions from the Mai Ndombe REDD+ ER Program in the Democratic Republic of the Congo. Available from: www.forestcarbonpartnership.org/sites/fcp/files/2014/July/LoI%20DRC%20%28Cover%20letter%20and%20Lettre%20d%27Intension%29.pdf

82. Ministry of Environment, Nature Conservation, and Tourism. Nov 2009. Second National Communication to the UNFCCC,Executive Summary. Kinshasa, Democratic Republic of the Congo. Available from: unfccc.int/resource docs/natc/rdcnc2exsume.pdf

83. See Appendix 1 to this report for more information, available online.

84. Merizalde Bermudez, Jaime. Aug 2010. Note Verbale. TS. UNFCCC Secretariat. Bonn, Germany. Available from: unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/colombiacphaccord_app2.pdf.

85. Institute of Hydrology, Meteorology, and Environmental Studies – IDEAM. Dec 2014. Proposed Forest Reference Emission Level for deforestation in the Colombian Amazon Biome for results-based payments for REDD+ under the UNFCCC. Bogota, Colombia. unfccc.int/files/land_use_and_climate_change/redd/application/pdf/frel_amazon_colombia_english_19_12.14_en.pdf

86. Institute of Hydrology, Meteorology, and Environmental Studies – IDEAM. 2014. Proposed Forest Reference Emission Level for deforestation in the Colombian Amazon Biome for results-based payments for REDD+ under the UNFCCC. Bogota, Colombia. Available from: unfccc.int/files/land_use_and_climatechange/redd/application/pdf/frel_amazon_colombia_english_19_12.14_en.pdf.

87. Peru nationally appropriate mitigation actions. Mar 2010. Available from: unfccc.int/files/meetings/cop_15/openhagen_accord/application/pdf/perucphaccord_app2.pdf

88. Emissions Reductions Program Idea Note. 12 Sep 2014. Forest Carbon Partnership Facility Carbon Fund. Available from: www.forestcarbonpartnership.org/sites/fcp/files/2014/september/PERU_ER-PIN_Sept.%2012.2014.pdf

89. National Environmental Action Plan 2011-2021. Jul 2011. Ministry of Environment. Available 89 from: www.bdlaw.com/assets/htmldocuments/Peru%20National%20Environmental%20Action%20Plan.pdf

90. Ministerio de Medio Ambiente y Agua. 28 Jul 2014. Fourth National Report. La Paz. Available from: www.cbd.int/doc/world/bo/bo-nr-04-es.pdf.

91. Republic of Bolivia. 2009. The National Forest and Climate Change Strategy. Available from: theredddesk.org/sites/default/files/National%20Forest%20and%20Climate%20Change%20Strategy%20Bolivia%202009.pdf.

92. Potapov, P. et al. 2011. Global map of forest landscape restoration opportunities. World Resources Institute: Washington, DC.

93. Ministry of Environment. Dec 2014. Ecuador's Forest Reference Emissions Level for Deforestation. Quito, Ecuador. Available from: unfccc.int/files/land_use_and_climate_change/redd/application/pdf/2014_december_frel_submission_ecuador.pdf

94. See Appendix 1 to this report for more information, available online.

95. Zero Deforestation Law. 2004. Government of Paraguay. Available from: assets.panda.org/downloads/ley_de_deforestacion_cero.pdf.

96. Paraguay extends Zero Deforestation Law to 2018. (2013). WWF Global. Available from: wwf.panda.org/who_we_are/wwf_offices/paraguay/?210224/Paraguay-extends-Zero-Deforestation-Law-to-2018

97. See Appendix 1 to this report for more information, available online.

98. Very few of Paraguay's forests are plantations, removing at least one of the objections to using Hansen data.

99. National Strategy for REDD+. (Jun 2012). United Republic of Tanzania. Vice President's Office. 2nd Draft. Available from: www.unredd.net/index.php?option=com_docman&task=doc_download&gid=7862&Itemid=53

100. If the FAO estimates are significantly inflated, and the Hansen estimate of an average 123,000 hectares of forest cover loss peryear (at 25% cover) along with 25,000 hectares of forest cover gain/recovery are more accurate, then less aggressive intervention may be necessary: cutting loss in half would achieve a rate below 0.2% per year; achieving 50,000 hectares of restoration per year on top of this cut would make Tanzania a net reforesting country.

101. We note that Hansen forest loss estimates for Mozambique are generally consistent with FAO data, but also that the Hansen total forest area estimates are highly dependent on the forest cover threshold used for these open-canopy forests. For example, there is a factor of 2 difference in total Mozambican forest area as estimated with a 25% and a 10% threshold.

102. Malaysia Second National Communication to the UNFCCC. 2011. Ministry of Natural Resources and Environment, Malaysia. Available from: unfccc.int/resource/docs/natc/malnc2.pdf

103. Malaysian Palm Oil Board. 2011. Oil Palm Area as Planted December 2011. Available from: bepi.mpob.gov.my/images/area/2011/Area_summary.pdf

104. Malaysia's Submission on Reference Levels for REDD+ Results Based Payments under UNFCCC. 2014. Ministry of Natural Resources and Environment. Available from: unfccc.int/files/land_use_and_climate_change/redd/application/pdf/malrl20141final.pdf

105. While forest gain estimates are consistent across FAO and Hansen data at about 28,000 hectares per year, the Hansen estimates of forest cover loss are less than half the FAO deforestation estimates – about 120,000 hectares per year for 2001-2012. On an emissions basis, these two sources are more consistent at about 60-70 million tonnes CO2 per year net emissions – in great contrast to Myanmar's reporting to the UNFCCC, which suggests a net forest sink of about 100 million tonnes CO2 per year.

106. National Sustainable Development Strategy for Myanmar. Aug 2009. National Commission for Environmental Affairs. Ministry of Forestry. UNEP Regional Resource Center for Asia and the Pacific. Available from: www.rrcap.ait.asia/nsds/uploadedfiles/file/Publication%201-NSDS%20Myanmar.pdf

107. www.protectedplanet.net/country/MM

108. Interim Action Plan for Climate-Compatible Development. Aug 2010. Office of Climate Change and Development. Government of Papua New Guinea. Available from: www.actnowpng.org/sites/default/files/Interim%20Action%20Plan,%20August%202010.pdf.

109. See Appendix 1 to this report for more information, available online.

110. Found at: www.environment.gov.au/land/publications/australias-native-vegetation-framework

111. WWF-Australia. 2014. Changing land use to save Australian wildlife. Available from: www.wwf.org.au/?11441/Changing-land-use-to-save-Australian-wildlife

112. WWF-Australia briefing 10 March 2015, Native wildlife at risk if NSW Native Vegetation Act is repealed. Available from www.wwf.org.au/news_resources/resource_library/?12820/Native-wildlife-at-risk-if-NSW-Native-Vegetation-Act-isrepealed.

113. Taylor, R. et al., Living Forests Report: Chapter 5 - Forests at Risk, WWF-International, 2015.

114. Canada's 6th National Report on Climate Change. 2014. Minister of the Environment. Available from: unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/nc6_can_resubmission_english.pdf.

115. 8th National Forest Inventory of the People's Republic of China, 2014

116. Russian Intact Forest Landscapes: current state and loss in the past 13 years // Karpachevskiy M.L., Kobyakov K.N., Aksenov D.E. (text). Moscow, WWF Russia, 2015. 2 pp. Available in Russian at: www.wwf.ru/resources/publ/book/980

117. Future of America's Forests and Rangelands: Forest Service 2010 Resources Planning Act Assessment, available at www.treesearch.fs.fed.us/pubs/41976/, accessed on 8 May 2015.

118. United States Climate Action Report. 2014. U.S. Department of State. Available from: unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/2014_u.s._climate_action_report[1]rev.pdf.

119. Based on FAO data. With Hansen tree cover figures, the 14 countries represent 61% of tropical forest cover.

120. Some countries that were not included in the analysis have put forward significant targets as well, such as Mexico's INDC pledge to reach zero deforestation by 2030.

121. Note that these countries may have also put forward conservation and reforestation pledges, in which case the remaining needed action to achieve ZND will be lower than that indicated here.

122. Wolosin, M. and Belenky, M. 2014. Gap Analysis with Paris Pledges. www.climateadvisers.com/wp-content/uploads/2014/12/Climate-Advisers-Paris-Analysis-Mind-the-Gap.pdf

123. Taylor, R. (ed.). 2011. WWF Living Forests Report. Chapter 3 - Forests and Climate: REDD+ at a Crossroads.wwf.panda.org/livingforests, WWF, Gland, Switzerland, WWF-International.

124. Lima, M.G.B. et al. 2014. The Contribution of Forests and Land Use to Closing Gigatonne Emissions Gap by 2020. Wageningen UR & WWF. Available from: d2ouvy59p0dg6k.cloudfront.net/downloads/wwf_wur_brief_final.pdf

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127-170 MILLION

Number of hectares of forest that could be lost in the deforestation fronts WWF has identified for the period 2010-2030

>50%

Forests are home to well over half of the world's land-based species

24%

The proportion of global anthropogenic greenhouse gas emissions that come from agriculture, forestry and other land uses

>75%

Over three-quarters of the world's accessible freshwater comes from rivers in or around forests

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